Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 66 NEW YORK, SATURDAY, JULY 3, 1915 No. 1

April Export Trade

THE figures of electrical export trade for April are a little bit encouraging in the fact that they show a slight gain over those of the same month a year ago. The respective amounts are $1,741,551 and $2,055,375. No particular item stands out except insulated wires and cables, where the jump is from $86,993 to $354,344. Such a fourfold increase is quite inexplicable, except on the assumption that most of the material of this kind now going forward is intended for military purposes of one kind or another. It is difficult to extract much comfort out of consumption of that character, even should it continue. Meantime the April figures as a whole imply a return to the higher levels of 1913 and 1914. Up to the present time the total for the ten months of electrical export in 1914-15 is $15,922,467. This compares badly with $21,569,687 in 1913-14 and $21,899,197 in 1912-13. We may hope that April shows a turn in the tide, for its average is comforting and encouraging. But we ought to be doing much better, unless the neutral nations and colonial markets are denying themselves and are going without electrical apparatus and supplies altogether. They may be drawing upon England for their electrical material, and her figures would be interesting; but she is about the only European country that can now be in the field with us to any serious extent.

Monopoly in Lighting Business

ONE of the factors in the decision of the New York Public Service Commission, Second District, authorizing the merger of the Buffalo General Electric Company and the Cataract Power & Conduit Company is that one company in a city is economically wiser than two companies, that competition is unprofitable for everyone concerned. Commissioner Carr points out that while at present the two companies do not compete to any extent, severe competition might have arisen and created serious difficulties. In most communities the idea that competition is a successful regulator has been discarded, yet there are still cities like Cleveland where an attempt is made to use this obsolete method. However, after sinking public capital in a competitive plant, the city of Cleveland is now seeking an opportunity to buy the private plant and thereby to establish a monopoly. It does not say now that competition is emancipation; it holds that derided monopoly is desirable. Whether or not in the future the relatively small Cleveland municipal plant and the privately owned central station shall be merged, the existence of monopoly in public utilities in an increasing number of cities and the reiteration by commissions of this wholesome principle of monopoly make it, with proper regulation, impregnable.

The Rate of Return

AS evidence in the rate case at Charleston, Mo., shows that money in that section commands 8 per cent interest, the Missouri Public Utilities Commission decides that the rate of return should be at least 7½ per cent. There is a natural and possibly irrelevant inclination to wonder why the commission clipped off the half of 1 per cent. If money is loaned at a minimum of 8 per cent on bankers' risks, which in reality are preferred loans, the public utility investment should carry not less than the same promised rate of return. The bank loan is made to prudent borrowers and is secured frequently by mortgage on farm land or by other collateral. The utility investment is sunk in a business venture, dependent for success upon commercial development and growth of the community. If it is the judgment of the commission that utility investments are to be regarded as equal in security to bank loans, that is a high compliment, because the percentage of loss in bank investments, compared with the volume of transactions, is small. The commission permits the company a return of "at least" 7½ per cent, and the maximum obtained under the decision may be above this figure. As in other like cases, the rate will be tested by the cost of additional capital for extensions and the return necessary on previous capital investment to make and keep the property productive, successful and in good credit.

Testing Incandescent Lamps

THE description of the lamp-testing equipment at the great Cleveland laboratory printed elsewhere in this issue gives some idea of the precision necessary in lamp manufacture. To the untechnical observer a tungsten lamp is a thing interesting but not particularly striking. It is a little glass bulb with an almost invisible wire strung back and forth across the legs of two straddle-bugs; but could he know the number of extraordinarily careful operations which go into the drawing of that wire from its ingot of tungsten and the delicate work of mounting the filament, and could he see the automatic machinery which forms every part precisely to measure, he would acquire a new respect for the commonplace little lamp and understand something of what its development has meant in expense and care. The testing laboratory here described is only one step, a preliminary one, in applying the test

of time to the finished product in order to see whether it is up to the standard of excellence that must be maintained. As is well known, the tungsten lamp is sensitive to variations of voltage, and to obtain a good and uniform life it is necessary even in a commercial way to keep the voltage well under control. In testing the lamps to ascertain what effect variations in manufacture have on the usefulness of the product, tenfold greater care is necessary to avoid the disturbing influence of change of voltage, which might quite mask the other variations that must be investigated. The fundamental part of lamp-life testing, therefore, is the preservation of accurately uniform voltage at the testing racks. The pains taken to secure this are described in detail, and it is just this sort of painstaking thoroughness which has given American incandescent lamps their reputation for uniform performance.

Criteria of Street Lighting

The night illumination of a street may be, and commonly is, viewed by different observers simultaneously from very different standpoints. One man will direct his attention to the magnitude and degree of uniformity of the horizontal illumination, another to the glare of the lamps, another to the color of the light, another to the esthetic appearance, another to the readiness with which obstacles to driving can be perceived, another to economy, and yet another to preconceived notions of what lighting ought to be as derived from persons or books. Is it any wonder, therefore, that different people posing as judges of street lighting—and every patriotic citizen considers himself qualified by the Declaration of Independence for passing judgment—should differ in their verdicts? Moreover, each of the protagonists can reasonably claim justification for the faith that is in him. In general, it would have to be admitted that something should be allowed for each different viewpoint. The ideal illumination in the streets on a dark night should be adequate, harmonious, pleasing, esthetic, economical and easily maintained. At best, therefore, any particular street illumination is likely to be a compromise, depending upon the local conditions. It will be generally agreed that what would be good street lighting for Broadway, New York City, would not be good lighting for a side street in a country village.

There is one comfort, however, about this complexity of claims to luminous superiority, namely, that the average reasonable citizen is less likely to be hypercritical than the average lighting expert. The latter has trained his eye to see details to which the happily ignorant, though possibly otherwise virtuous, citizen is completely blind. Consequently, if one or two lighting experts of good perspective and sane judgment pronounce a section of street well lighted, the verdict is not likely to be reversed on appeal to the public. Although some particular householder may happen to entertain strong opinions as to what good lighting ought to be, yet he is likely to be in a marked minority. Long before the citizens are likely to notice with justification that the lighting is unsatisfactory in relation to its expense, the trained observations of the specialist will have condemned it.

It remains, therefore, for illuminating engineers to study and formulate the conditions and rules which determine good lighting for each type of street service. In so far as these conditions are quantitative and admit of being measured, as by the photometer or by the expense book, there is likely to be little dispute over them. It is in regard to matters of esthetic taste and appearance that differences of opinion are likely to present themselves. But such committee reports of specialists are likely to bring about the desired agreement and are most acceptable contributions to the literature of illuminating engineering.

Practical High-Tension Working

One of the most instructive Institute papers which it has been our fortune to read is that by Mr. A. Bang of the Pennsylvania Water & Power Company on the operation of the hydroelectric system which furnishes energy from the Susquehanna River to Baltimore. The author gives an account of the operative side of the work with special reference to the line and the troubles encountered on it during the past four years. A summary of troubles on the line shows a total of eighty-four complete and partial interruptions of service during this period, of which seventy-two were due to lightning, six to turkey buzzards fouling the line, four to an overload of sleet on the cables, and two to defective insulators. In addition there were nearly half as many slight disturbances in which no synchronous load was lost and which practically did no damage. Now, the interesting part of this record is the enormous predominance of damage from lightning, in spite of the fact that the circuits are equipped with grounded cables and protected on both ends with aluminum lightning arresters, and in spite furthermore of the very high factor of safety on the insulators. It was found that the damage from lightning was very commonly due to a flash-up alongside the string of insulators from conductor to tower. As a rule the conductor is not burned off by the arc, although some damage is frequently done. On this particular line the chief operating difficulty proved to be flashing over at the insulators, in spite of the many disks used and the great insulating property of each individual disk. Considerable amelioration has been obtained from line troubles due to lightning by the use of special protective devices. Two forms of installation are used for this purpose, each actuated by relays in the usual manner to throw the system into action whenever a short-circuit occurs on the line. The first of these shunts the short-circuit by a fuse the moment it occurs. The fuse is calibrated to blow in less than a hundredth of a second, which is rapid enough to kill the arc on the line which the fuse shunts. The whole protective device is installed just outside of the power house and is usually successful in breaking the arc before there is time to lose any of the synchronous load. The second apparatus

kills the arc by momentarily lowering the field of excitation of the generators and restoring it as soon as the arc dies out. In actual service this is cut in, so to speak, behind the shunt fuse apparatus. The practical result is, at the possible loss of some synchronous load, most effectively to suppress the arc on the line whatever its source. These methods of reducing the line troubles from lightning are remedial rather than preventive, but in the former aspect they certainly are of very great usefulness.

Another operating feature brought out in Mr. Bang's paper relates to the progressive failures of insulation. By insulation tests it was found that after some three years of operation many insulators which were giving apparently good service had lost a serious amount of their insulating properties. Six months later a second test showed an increased number of insulators to have gone bad, the total failures in the two tests involving 12 per cent of the entire number of insulators. Although experience indicated that actual break-downs of the system directly from this cause were unusual, it is still not at all unlikely that the failure of entire strings from lightning might in numerous cases be charged to insulation weakness in some of the units. However this may be, an examination of the circumstances showed very clearly that the damage was not due directly to electrical strains, but was probably caused either by cracks or by porous spots in the insulators, the former perhaps developing as a result of continued mechanical strain, the latter being structural faults eventually becoming serious from the very gradual infiltration of water. Tests by heating and cooling gave signs that some of the internal stresses might co-operate with the general mechanical stresses to produce incipient cracks, although the mechanical strength of the disk seems to have suffered very little. Insulators which showed low resistance were temporarily and sometimes permanently cured by careful baking out. Very slight cracks under the cap seem to be quite commonly associated with low insulation strength, but in some cases failure seems to have been due to imperfectly baked porcelain rather than to any local defects. At all events, the tests showed very clearly that suspension insulators, like all others, are subject to failure, and in particular to deterioration in their insulating power, after they have been put into use.

It would be interesting to know whether a proper insulation test will show this deterioration as frequently in pin-type insulators as in the suspension units where a somewhat greater strain is put upon the porcelain. If the phenomenon is a common one with disk insulators, the desirability of re-design with particular reference to this situation will be plainly indicated. It is certainly evident that periodical insulation tests ought to be made to insure the maintenance of the factor of safety in insulation necessary to continuous and safe operation. We wish that more papers of this extremely practical and useful sort regarding the operation of transmission systems could be laid before our engineering societies. It is the line more than anything else which determines the success of a transmission system, and which at the same time offers the most intricate and troublesome operating problems.

Unbalanced Voltage and Current Relations

As we all know, it is a very common procedure, in distributing energy from three-phase mains for lamps and motors, to supply the energy to the lamps, when in small groups, from one phase, and to the motors up to a certain small size from one phase, and then up to a larger size from two phases. This last means the use of the so-called open-circuit delta connection. It has the advantage of calling for only two step-down single-phase transformers instead of three. The result of an open-delta delivery is well known to bring about a certain amount of unbalancing of the system and of overloading of the two transformers. The unbalancing can be kept in check by supplying energy to different open deltas from different pairs of mains. The dissymmetry of the power delivery through an open-delta transformer pair makes a computation of the voltages and currents in the system more difficult than in the ordinary symmetrical three-phase case. An article by Mr. B. F. Jakobsen on these quantitative conditions appears in this number. It contains workable formulas for dealing with the open-delta transformation.

Incidentally, the article furnishes a good illustration of the absence of necessity for dots underneath algebraic symbols to denote vector quantities. These dots could all be spared for some more pointed purpose by stating at the outset that all of the equations to be presented are to be interpreted vectorially. Where everything is dotted why not cross all the dots off and start afresh, with clear type and conscience? It is true that in mathematical reasoning involving both real and complex equations by turns it is desirable, for logical reasons, to indicate which is which. But if one term of an equation is a vector, then the whole of that equation must be vector, and a mark against the unit of that equation suffices without hanging a button label on each and every term. One cannot logically have an equation half scalar and half vector. This is, of course, a mere question of notation, and in no sense a criticism of the mathematical reasoning in the article.

The author clearly shows that the overloading of an open-delta transformer pair, at full rated power delivery, is a consequence of the dissymmetry, and will occur even if the secondary three-phase system can be kept balanced. The unbalancing, on the other hand, is shown to accompany even symmetrically balanced secondary loads, owing to the drops of pressure in the two transformers, which are dissymmetrical with respect to the three-phase system. Many readers will derive more insight into the actions of an open-delta delivery from the excellent examples worked out in the article than from the general formulas under which the solutions are obtained. The general case dealt with in the article can apparently be somewhat simplified by first substituting for the given delta load, balanced or unbalanced, its equivalent Y load.

LETTERS TO THE EDITOR

Classifications of Applied Science

To the Editor of the ELECTRICAL WORLD:

SIR:—The joint committee on classification of technical literature, Engineering Societies Building, New York, is extremely desirous of obtaining the assistance of your readers in making a collection of classifications of applied science which have been developed independently in the offices of manufacturing plants or engineering firms, especially those in manuscript form that have been used for filing or indexing data.

The committee would especially like to have copies of any extensions of present systems to cover any special industry or branch of engineering which is not now fully covered by the published classifications.

W. P. CUTTER,
New York, N. Y. *Secretary Joint Committee on Classification of Technical Literature.*

Illumination Units—Past and Present

To the Editor of the ELECTRICAL WORLD:

SIR:—As an example of the ambiguity of the terms used in photometric discussions in former years I wish to quote a paragraph taken from Ganot's "Physics" (Atkinson), 1902 edition, page 523, as follows:

"Our requirements as regards illumination are constantly on the increase. Thus for public receptions of a state character in recent times in Paris a number of lamps was used corresponding to over 13 candles per square yard, which is six times as much as was used on the occasion of the marriage of the Dauphin in 1745. The former, however, is still far removed from perfect illumination, that of daylight, which is estimated at about 180 candles per square yard."

The candle referred to is the old English candle burning 120 grains an hour.

The term "candles per square yard" gives a vague idea of the illumination at these state functions. Assuming that the term "candles per square yard" means that an equivalent of thirteen of our spherical candle units were distributed over each square yard, and that the total flux of light was delivered to the area to be illuminated, the illumination of 13 candles per square yard would be approximately 18 foot-candles. It is improbable, however, that such was the case, and in the absence of statements of lumen values per square foot no accurate conception of the illumination can be formed. The value of 180 candles per square yard would be equivalent to approximately 250 foot-candles for average daylight.

The term "candles per square yard" is supposedly used to indicate the equivalent horizontal spacing of the light units. Thus, in the time of the marriage of the Dauphin, in 1745, about two 1-candle units were placed per square yard of floor area.

Referring now to more recent times, there appears in a handbook for superintendents and electricians issued by the Industrial Commission of Wisconsin in 1914 a similar expression for illumination: "An artificial light equivalent in amount, for each 4 square feet of floor space, to not less than the light produced by a 1-candle-power lamp hung 10 feet from the floor."

The above definition of illumination is meaningless unless associated with data on the flux distribution of the 1-cp unit. Certainly, such a definition is more complicated than the foot-candle, which is 1 lumen per square foot.

At the present stage of development of illuminating engineering, there is no excuse for the use of vague and incorrect terms. In writing books in popular language it is not necessary to use complicated and erroneous definitions rather than the recognized terms.

Washington, D. C. DAVIS H. TUCK.

Competition in Small-City Public Utility Operation

To the Editor of the ELECTRICAL WORLD:

SIR:—At the present time public utilities and public utility investments are in a very precarious position. On the one hand, the different public service commissions throughout the country are bending every effort to regulate and adjust the utility rates to a basis that will not permit the utility more than a fair rate of return as a maximum on a fair valuation of the properties used and useful, while at the same time the public is clamoring for a greater reduction than that ordered by the commissions. Besides this, there is ever present the threatened possibility of municipal-ownership competition, and further, if for any reason a municipal plant is not possible, the community is ever endeavoring to obtain and doing everything possible to encourage a competitive utility.

At its last legislative session the Senate of the State of Oregon passed a bill the purpose of which was to require that a certificate of convenience and necessity be granted by the Railroad Commission to a proposed competing utility before the proposed competitors could enter a field already served. The House, however, after the most bitter debate, refused to pass the bill in any form.

The Legislature of the State of Washington at its last session enacted a piece of legislation of this kind. At this date, however, before the law has gone into effect, a referendum petition is being circulated to hold a special election for the purpose of voting on the recall of the law.

The attitude in Washington and Oregon is typical of that throughout the country. The reason for this attitude on the part of the consumer is fundamental. The average individual cannot understand why there should not be competition in any private commercial enterprise. He is opposed to any trust, and the fact that a public utility is a natural monopoly, a regulated one or any other type, makes absolutely no difference in his mind. It is a utility corporation, a trust, and that ends it. He admits that the electric-light company has some investment in plant, wire and poles; however, this in his mind is almost negligible. He sees the water running in the stream before it enters the generating station and after it comes out, and arrives at the illogical conclusion that it costs the electric company nothing for what he is compelled to pay an outrageous price. Consequently, his entire attitude is antagonistic and he breaks forth in a denunciation of the electric company at every possible opportunity.

Our public service commissions have been and are making a sincere, conscientious effort to ameliorate the public utility problem. But, at best, in most cases their endeavor can be but an effort. It is useless for me here to go into the various phases of commission regulation failure. Suffice it to say that to those at least who have been working in one manner or another with the various commissions it is becoming ever more apparent that the public utility problem is not possible of entire and ultimate solution by regulatory commission alone. For proof of this fact one has but to study the condi-

tions that exist to-day in any of the states that have had commission regulation for several years. Possibly as good an example as any is the State of Wisconsin. I refer to the famous Milwaukee street-railroad fare case, which took approximately six years from the initiation of the complaint before the order of the commission was filed. It is sufficient to say that the above condition of affairs is not entirely exceptional, and under such conditions—if for no other reasons, of which there are many—commission regulation loses a major portion of its effectiveness. However, the various commissions are doing a wonderful service now, and will continue to do so in the future.

I have already stated that the average individual will not willingly tolerate a trust or monopoly privately owned. Consequently he demands and insists on having competition or public ownership, and in many instances, the number ever increasing, public ownership, regardless of competition or regulation.

What has been and is the result of this attitude? Is it not ever-decreasing revenues and increasing demands for better service, regardless of the rates being charged or the class of service rendered? I think the day is past when a utility can expect to earn more than a fair return.

Public Utility Investment

Let us next turn to public utility investment. Public utility securities, I believe, should rightly be one of our prime investments. However, the condition that exists is that a public utility investment is rapidly becoming a very poor speculation. This condition exists because the average individual will not tolerate a monopoly of any kind under any condition, if the monopoly is privately owned.

The solution of this problem is fundamental and can be wrought only by bringing about a change of attitude on the part of the individual consumer from that of antagonism to that of co-operation. If the consumer's co-operation is to be attained, it must be brought about by some simple, direct, easily understood and visible means.

This, I believe, can be best done by making the consumer, by contract with the municipality, a partner in the operation of the utility serving him. The simplest, most direct and tangible method to obtain this desired end is to share the net returns with him. I believe this can be done to mutual advantage by the utility entering into a contract with or obtaining a special franchise from the municipality in the following manner:

A fair value of the property used and useful, as of a certain date, and rates of depreciation, together with other details, shall be agreed upon by the assistance of the regulatory commission or otherwise. This fair value having been fixed and other details arranged, the next step will be to fix a minimum rate of fair return. As an example in this discussion, I shall use 6 per cent as the minimum rate of fair return on the fair value of the investment used and useful, fixed as above as the basis on which to figure the fair return. I wish to add, however, that this minimum return might be more or less than 6 per cent according to the existent local conditions.

On the other hand, if by efficient operation and good management, at the end of the fiscal year the utility shows that it has earned 7 per cent, 0.5 per cent will be turned over to the municipality and the utility will retain 6.5 per cent. If a total of 8 per cent has been earned, the municipality will get 1 per cent and the utility 7 per cent. This arrangement, or one with a somewhat similar division of the earnings over and above the fixed minimum rate of fair return, could be carried to a point that would give to the utility a previously fixed maximum net percentage of return. For the sake of this discussion let it be assumed that 9 per cent is the fixed maximum rate of fair return allowable to the utility under the most desirable operating conditions. Then all over and above this fixed maximum of 9 per cent to the utility would go to the municipality. Now, referring again to the fixed minimum of 6 per cent, if the utility does not show a return of 6 per cent at the end of the fiscal year, but instead (let us assume) only a 5 per cent net return is realized, then this 1 per cent loss shall be carried by the utility in an accumulative deficit account. This deficit account may or may not carry an interest rate, this depending upon the local contract with the municipality. If the following year also shows a deficit below the guaranteed 6 per cent minimum, this deficit shall be added to the deficit of the preceding year, continuing in this manner until a return greater than 6 per cent is shown. After the utility begins to show a return greater than the guaranteed minimum the amount over and above the 6 per cent shall be applied to amortize the deficit of the preceding years before the municipality shall receive a division of the returns that are realized greater than the guaranteed minimum.

By the above method the consumer becomes a partner in the operation of the utility serving him and will as a consequence, I believe, take a material interest in the economical operation of his utility. Moreover, on a basis of this kind he would not encourage or demand competition. He could also, I think, be brought to see, if a low enough minimum is used, that he is getting as low rates and more efficient operation than if served by a municipally owned plant. Consequently the possibility of a municipal plant in competition with the privately owned utility would be largely removed, and possibly entirely so.

Effect on Value of Utility Securities

The effect of a franchise or contract of this kind would be immediately reflected in the marketable value of the public utility securities. Under an operating plan of this sort the fair rate of return would be absolutely guaranteed, the possibility of competition would be almost entirely removed, and the municipal ownership menace made a remote probability.

In order that the value of a contract or franchise of this sort should be properly reflected in the value of the securities of a utility, it would be necessary that the utility obtain a term agreement with the municipality of at least ten years. Moreover, an agreement of this sort would in many instances require an amendment to the city charter. In some states it would possibly conflict with the public utility law. However, I am convinced that all these difficulties can be readily overcome where it is the desire to do so, and that the plan would work out for the small electric utility in its field as satisfactorily as the Chicago street-railway and the Boston gas utility co-operative plan have worked out in their respective cities.

The writer also appreciates the fact that the regulatory commission would still have the power to order a franchise or contract agreement similar to the one herein outlined canceled or changed according to its ideas on the subject; but he feels that the incentive to do so would be materially weakened, for the reason that an agreement as herein outlined is fundamentally just and equitable to both the consumer and the utility. Therefore, except in cases of gross misconduct in the operation of a co-operative plan of this kind, it would appear that the various regulatory commissions would have a decided tendency to encourage and assist in the successful operation of the plan.

Portland, Ore. B. A. BRACKENBURY.

Annual Convention A. I. E. E. at Deer Park, Md.

Transmission-Line Construction, Railway Contact Systems, Wave-Forms, and Electrical Properties of Materials Among Topics Discussed

DURING the present week, from June 29 to July 2, the American Institute of Electrical Engineers held its thirty-second annual convention at Deer Park, Md., where the registered attendance reached 200 on Wednesday. Although the reception to President Paul M. Lincoln was not held until Tuesday evening, the formal-paper program began on Tuesday forenoon, the first item being the presentation of the annual presidential address.

Address of President Lincoln

In his opening address President Lincoln discussed early and modern progress, present status and possible future growth of electrical engineering. He called attention to the high efficiency of modern electrical generators and motors and stated that the margin between present-day efficiencies and perfection in this respect, less than 10 per cent, is too small to justify the expectation of any considerable improvement, while even less improvement can be expected in transformers, now reaching 99 per cent efficiency, and synchronous converters, with efficiencies of 98 per cent. Hydraulic turbines frequently reached 90 per cent in efficiency so that a margin of only 10 per cent remains for improvement.

The thermodynamic efficiency of engines depends upon the ratio of the temperature range to the absolute temperature, and 75 per cent of the ideal thermodynamic efficiency is now being obtained. Without a great increase in the temperature range there can be no appreciable increase in the thermodynamic efficiency. For the purpose of increasing the range of temperature Mr. W. L. R. Emmett has developed the method of utilizing mercury in combination with water as the working fluid. This method removes some of the limitations of water and is quite promising. The chief difficulties encountered relate to the leakage of mercury.

The Rapid Advance of the Art

In his presidential address in 1894 Dr. A. E. Kennelly stated that 4600 kw. was the rating of the largest generator then built. Generators are now constructed having a rating seven times as great as that of the 1894 machine and can be built in even larger ratings if justified by the service to be rendered.

Owing to the increasing costs of labor and material, it is not probable that there will be any great reduction in the cost of electrical machinery. Not much improvement is to be expected in materials of construction. In magnetic materials the permeability is high and the losses low, while in conducting materials practical perfection has been reached so far as copper is concerned. The permissible output of electrical machinery is limited by the maximum temperature which the insulation will withstand. The temperature may be increased by utilizing better insulating materials, and some improvement may be looked for here.

While the prospects for revolutionary improvements in electrical machinery are not great, yet possibilities for applications are unlimited. Merely a fair beginning has been made in the utilization of electricity for traction, industrial service, etc., and great possibilities still remain for improvements in lighting in spite of the 1000 per cent increase made in the efficiency of light production during the last seventeen years.

President Lincoln claimed that electrical engineering developments have long since passed through the infancy stage and are now rapidly approaching manhood. Evidences of the great stability of the industry are now seen on all sides.

Section Committee Meetings

At noon on Tuesday, Wednesday and Thursday meetings were held of the section delegates with such members of the board of directors as could attend to discuss the sectional affairs of the Institute. After a full discussion of the proposal to create sectional vice-presidents or select the vice-presidents in accordance with the territory to be represented, it was unanimously voted that the sense of the meeting was that the delegates did not desire sectional vice-presidents.

Below are given abstracts of the papers read at the sessions on Tuesday forenoon and afternoon and Wednesday forenoon, together with abstracts of the discussions following their presentation. In a later issue will be published abstracts of the papers and discussions at the later sessions.

Electric Strength of Air

In the sixth of a series of papers on "The Electric Strength of Air," Prof. J. B. Whitehead of Johns Hopkins University outlined the experimental basis upon which the modern conception of the structure of the air rests, and described several resulting theories of the nature of high-voltage corona. One of the strongest evidences of the correctness of modern theories of the electric behavior of gases is found in their accord with the kinetic theory of gases. The conductivity of air is due to its having mixed with it electrified particles, or ions—some positive, others negative. With uniform ionization between two parallel plates and a voltage high enough to produce saturation, the current increases with increasing distance between the plates. The current passing through a gas is equal to the difference between the number of new ions formed per second and the number which disappear by recombination and diffusion. One of the most important properties of gaseous ions is their motion through the gas under the influence of an electric field. Values of the velocities of the ions and methods of finding them for different gases were given. The charge on an ion is the same for all gases, its value being that carried by the hydrogen atom in the electrolysis of solutions. The author presented a brief history of the physical researches which led up to the discovery of the electron, following this with a review of conductivity due to electrons. The second half of the paper was devoted to theories of corona formation, including those of Townsend, Russell and Davis, and developing in particular the first-named, which argues that the corona may be explained on the theory of collision.

Discussion

Messrs. P. H. Thomas of New York, F. W. Peek, Jr., of Schenectady, E. E. F. Creighton of Schenectady, Harris J. Ryan of Palo Alto, Cal., and L. W. Chubb of Pittsburgh took part in the discussion.

Professor Ryan remarked that the theory of ionization by collision is now merely in its infancy but is rapidly growing. He said that the studies of corona phenomena have not been completed, citing the case of the effect of increase in the frequency upon the sparking distance. With a 15-in. gap only one-fifth as great

an increase in the voltage is needed to break down a certain added length of air-gap, with a frequency of 90,000 cycles per second as with a frequency of sixty cycles per second. This result is attributable probably to the holding over of the ionization from cycle to cycle. In the investigation of corona use should be made of all voltages, frequencies, impulses, wave trains, etc.

Paths of Flux Lines from Irregular Bodies

In his paper entitled "The Reluctance of Some Irregular Magnetic Fields," Mr. John F. H. Douglas gave an outline of the development of the idea of magnetic reluctance, a description of experiments to determine the path of flux lines through irregular metal sheets, and an analysis of magnetic fields in various electrical apparatus to see if the same flux conditions hold true as in sheets. To determine the reluctance in irregular bodies use was made of the similarity of electric and

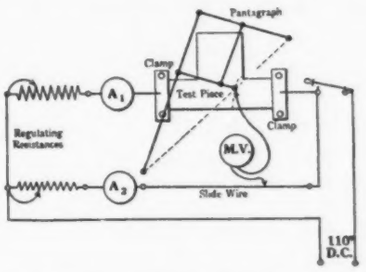


DIAGRAM OF CONNECTIONS USED IN EXPERIMENTS

magnetic circuits and the conjugate character of flux and potential lines. The apparatus employed in tracing equipotential lines is shown in the accompanying illustration. A number of diagrams were presented to show the path of flux lines—as determined by this apparatus—from field poles to armature, across armature slots, around square and round poles, between main poles and interpoles, through transformer cores, etc. The results of the experiments have also been embodied in formulas, curves and tables for the use of designers. A solution of the much discussed sine-wave alternation problem was also given.

Discussion

Messrs. Charles R. Underhill of New Haven, John B. Whitehead of Baltimore, C. A. Adams of Cambridge, F. W. Peek, Jr., of Schenectady, J. D. Ball of Schenectady, P. M. Lincoln, and L. W. Chubb of Pittsburgh, took part in the discussion.

Mr. Underhill called attention to the necessity for separating the effects of the coil and the core in determining the performance of plunger magnets.

Mr. Peek showed that the method of analysis employed by the author in studying the magnetic field can be so modified as to be applicable in the study of the electrostatic field.

Mr. Chubb claimed that in actual practice it is preferable to base the designs on simple approximate formulas rather than attempt to make a complete accurate analysis of the phenomena dependent upon so many variables as are found in the magnetic circuits of electrical machinery.

Form-Factor and Its Significance

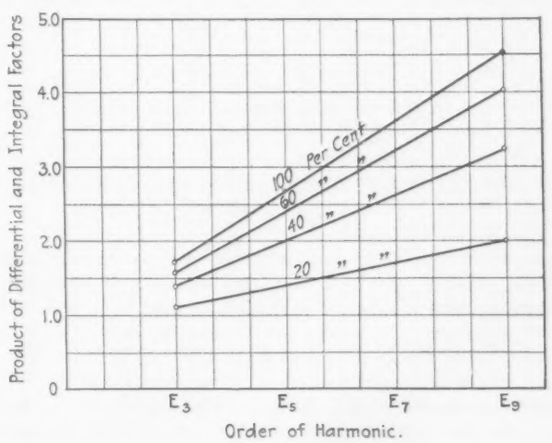
A paper on form-factor and its significance, prepared by Mr. Frederick Bedell with the assistance of Messrs. R. Brown and H. A. Pidgeon, treated of the significance of form-factor in the study of transformer losses. The hysteresis loss of a transformer is small when the form-factor is large, and vice versa. If the effective voltage is increased or decreased in direct proportion to the form-factor, the hysteresis loss in a transformer remains unchanged. Although hysteresis loss depends in a definite manner upon form-factor, the latter has no useful significance as an indication of the shape of a wave or its departure from a sine wave; in fact, an irregular wave may have a third harmonic as large as 75 per cent of the fundamental, and if the harmonic is in proper phase, still have the same form-factor as a pure sine wave. In the case of a complex wave having a sinusoidal fundamental, the form-factor depends not only upon the amplitude of the harmonics but also upon their relative phase relations. This form-factor may be obtained by dividing the square root of the sum of the squares of the root-mean-square values of the fundamental and the several harmonics by the average voltage, which may be found by integration from the maximum instantaneous voltages of the fundamental and the harmonics. The resultant expression, given below, shows that the form-factor varies with the phase as well as with the amplitude of the harmonics:

$$f = \frac{E}{E_{av}} = 1.1107\,\frac{(E_1^2 + E_3^2 + \ldots.)^{1/2}}{(E_1 + \frac{1}{3}E_3\cos 30_3 + \ldots)}.$$

In this equation E_1, E_3, etc., may represent either root-mean-square values or maximum values of the various harmonics of the order indicated by the subscripts.

Characteristics and Significance of Distortion Factors

The characteristics and significance of several types of wave-distortion factors were discussed in a paper prepared by Mr. Frederick Bedell assisted by Messrs. R. Bown and C. L. Swisher. In general, the distortion of a wave can be indicated by any one of several factors—deviation, curve, harmonic, peak, differential and integral factors—but some are more easily obtainable or give different weights to various characteristics of the wave. For instance, harmonic factors are independent of the phase and order of harmonics present. On the other hand, peak and form factors are much affected by the phase relation of the wave components, while deviation factors are less affected, and crest, harmonic, differential and integral distortion factors are not affected at all thereby. The integral distortion factor gives lit-



VARIATION OF PRODUCT OF DIFFERENTIAL AND INTEGRAL FACTORS

tle weight to the order of a harmonic, and curve factors and harmonic factors give no weight at all to it. The harmonic factor, or percentage of the combined harmonics, is very definite in its significance, for it states exactly which components of a wave are present in addition to the fundamental sine wave and so gives directly the information that is desired for many purposes. This factor is not convenient for general use as there is no

ready method for determining it. In this respect the integral and differential distortion factors—or a combination of the two—offer, it is believed, perhaps, the greatest possibilities for usefulness. Some of the uses of each type of distortion factor were given, the curve factor being valuable in determining the torque of an induction motor, while the peak factor is useful in insulation testing.

Discussion

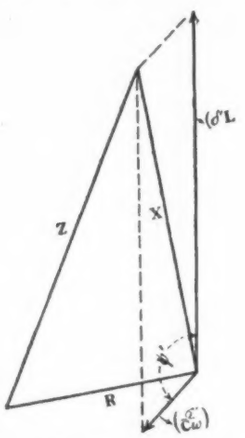
The two papers were discussed by Messrs. L. W. Chubb of Pittsburgh, W. V. Lyon of Boston, and Frederick Bedell of Ithaca, N. Y.

Mr. Chubb showed that the form factor cannot properly be based on the areas of the irregular curve taken from the zero points of the fundamental waves but must be based on symmetrically placed zero points on the resultant irregular wave. In a written communication Mr. Lyon, who also called attention to the limitations in the significance of the integrations indicated by the authors, presented a mathematical analysis of certain of the relations involved.

Dr. Bedell stated that while the equation and curves derived were not exact, yet they represented possible approximate solutions to problems so complex as not to admit of any exact simple solutions.

A Practical Use for Distortion Factors

In the paper describing "An Analytical and Graphical Solution for Non-Sinusoidal Alternating Currents," presented by Mr. F. M. Mizushi, there were developed, both analytically and graphically, equations showing the relation between R, L, C, I and E in circuits when the



RELATION BETWEEN CIRCUIT CONSTANTS WITH R, L AND C IN SERIES

electromotive force and current waves are not sinusoidal. When an inductor, condenser and resistor are in series the following equation holds:

$$E = \left[R^2 + (\delta' L\omega)^2 + \left(\frac{\sigma'}{C\omega}\right)^2 - \frac{2L}{C}\right]^{\frac{1}{2}} I = ZI,$$

where Z is the impedance of the circuit and δ' and σ' are respectively the differential and integral distortion factors for current. When an inductor, a condenser and a resistor are connected in parallel, the equation becomes

$$I = \left[g^2 + \left(\frac{\sigma}{L\omega}\right)^2 + (\delta C\omega)^2 - \frac{2C}{L}\right]^{\frac{1}{2}} E = YE,$$

where Y is the admittance of the three circuits in parallel, and δ and σ are respectively the differential and integral distortion factors for voltage. In both series and parallel circuits, not only are the effects of L and C changed in value by distortion but these effects are changed relatively in phase and are no longer in exact phase oppositon, as is the case with sinusoidal currents and voltages. The mathematical transformations on which the solutions were based were given in an appendix.

Discussion

The joint committee on inductive interference sent from San Francisco a telegram of several thousand words relayed from Pittsburgh to Deer Park by telephone, in which attention was called to the disturbances in telephone lines produced by the high harmonics in the distorted voltage or current waves in adjacent high-tension or heavy-current transmission lines. When the frequency of the harmonic waves is from 200 to 2000 cycles per second audible effects are produced in the telephone receivers. The disturbing effects reach their maximum at about 800 cycles, corresponding to the thirteenth harmonic in a sixty-cycle system. Up to this frequency the disturbance varies as the square of the frequency and in direct proportion to the amplitude of the harmonic.

After having discussed the Institute definitions of form factors, deviation factors, etc., the committee suggested the adoption of designations that will serve to penalize the production of those overtones having a detrimental effect upon telephone circuits.

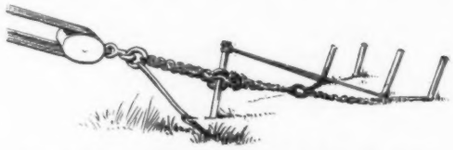
The paper was also discussed by Messrs. H. S. Osborne of New York, Chester L. Dawes of Cambridge, Mass., E. E. F. Creighton of Schenectady, J. B. Whitehead of Baltimore, C. A. Adams of Cambridge, and W. J. Foster of Schenectady.

Mr. Foster said that a large waterwheel-driven generator had been designed and built in which the harmonics have been minimized by means of the "Vernier action" of the teeth. He expressed the opinion that while it is possible to build machines of limited size which produce sinusoidal waves, yet the cost thereof would probably prove practically too great.

Transmission Tower Foundations and Tower Erection

Results of lifting tests with various types of transmission-tower foundations, advantages of concrete mushroom stubs, cost of making three types of foundations, methods of "staking out" holes, digging them, pouring concrete, and assembling and erecting towers, and descriptions of equipment used in these operations, were given in a paper presented by Mr. J. A. Walls, vice-president and chief engineer of the Pennsylvania Water & Power Company.

The lifting tests showed that tripod-type and single-leg stubs pulled out of fresh earth at about 32,000 lb. and 23,000 lb. respectively, while concrete mushroom stubs showed no signs of lifting or cracking the soil up to the limit (70,000 lb.) of the testing outfit. With 50 per cent of the ultimate load exerted on each type, single legs shifted more than 1 in., tripod stubs about 0.25 in. vertically and 0.3125 in. horizontally, while mushroom stubs moved but slightly. From investiga-



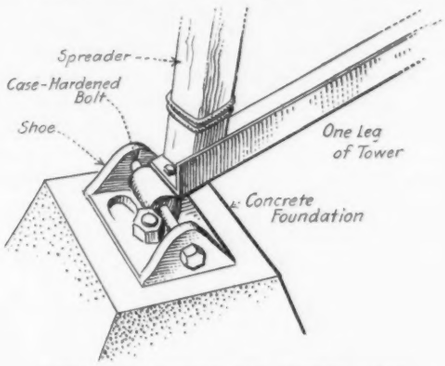
METHOD OF DEAD-ENDING HEAD TACKLE

tions made with four types of mushroom stubs, it was found that those made without forms, by pouring concrete into vertical cylindrical holes with bell-shaped bottoms, were cheapest to construct and did not disturb the adjacent earth or require backfilling. Next in order regarding cost and rapidity of construction were stubs made with steel and wooden forms.

Excavations were opened in rocky soil by punching 4-ft. holes and placing one-half stick of 60 per cent dynamite at the bottom, one-half stick of 40 per cent dynamite 8 in. higher, and a similar charge 20 in. from the top.

OVERCOMING OBSTACLES

Water found in holes was removed with a boat pump, but it was suggested that when holes fill up very quickly

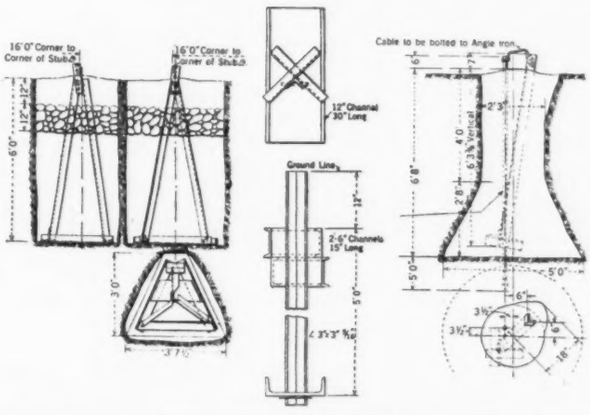


DETAIL OF HINGE FOR TOWER LEGS

it may be advisable to pour concrete into them through 6-in. sheet-iron pipes to prevent the cement being washed out of the mixture. As bedplates were not on hand when the foundations were being made, the latter were left 8 in. below the final grade and finished as soon as the plates arrived, "toxement" being employed to form a bond between the new and old concrete. The plates were placed on the concrete while it was soft and hammered to grade.

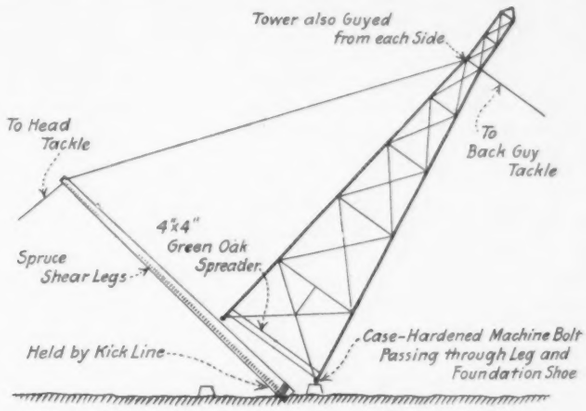
EQUIPMENT FOR ERECTING TOWERS

Wherever possible, the towers were assembled on the ground in a horizontal position. The general scheme of erecting them was to pivot the two lower legs to the foundations and hoist them by means of tackle connected just below the cross-arms and running over a shear leg, attached to the base of the tower, to temporary anchors or dead-ends installed at a convenient distance ahead of the foundations. Side-guy and back-guy tackles were employed to steady the towers while they were being hoisted. Five 2.5-in. iron pins 5 ft.


16'0" Corner to Corner of Stub
16'0" Corner to Corner of Stub
12" Channel 30" Long
Ground Line
2'-6" Channels 15" Long
Cable to be bolted to Angle Iron

TRIPOD, SINGLE-LEG AND CONCRETE MUSHROOM STUBS

long were driven in the ground, as shown, to anchor the main tackle. In hoisting 40-ft. towers $\frac{5}{8}$-in. case-hardened machine bolts passing through extra-heavy foundation shoes were employed for hinges, while 1.25-in. bolts and $\frac{3}{4}$-in. plate channels were used with heavier towers. The shear legs consisted of two 45-ft. spruce poles bolted together near the top so that the butts would be about 16 ft. apart. To raise them into position so they could be lashed to the base of a tower the butts were placed near the hinged tower legs, and a cable was attached to the apex of the shear leg, passed over a 4-in. by 4-in. timber placed across the upper legs of the tower, and hauled in by tackle dead-ended at the


Tower also Guyed from each Side
To Head Tackle
To Back Guy Tackle
4"x4" Green Oak Spreader
Spruce Shear Legs
Held by Kick Line
Case-Hardened Machine Bolt Passing through Leg and Foundation Shoe

METHOD OF RAISING TOWERS

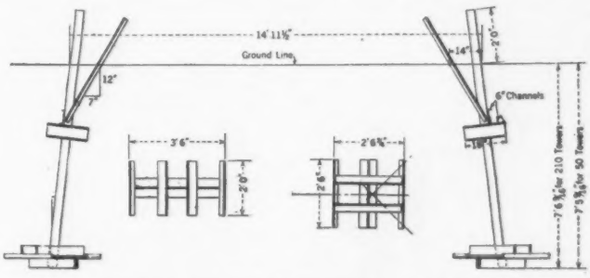
back-guy anchors. This operation was a good test for the stability of the pins.

The stability of the main-tackle pins was tested by pulling in the lead line enough to raise the tower slightly. If the anchors showed no signs of pulling out, hoisting was continued slowly. Too rapid raising is objectionable, as guy pins may be pulled out by fouling of the tackle. When a tower approached the position where gravity tended to right it—which was indicated by there being practically no tension in the hoisting tackle—the back guy was drawn taut and let out very gradually as the tower dropped into position. Just before the unhinged legs touched the foundation shoes the spreaders were removed so that the angles could be guided over the foundation bolts. Replacement of the hinges by shoes was permitted by pulling the tower slightly forward with the main tackle.

Before moving the hoisting equipment to the next site the tackles were let out or taken in, depending on which condition they would be required in next. The shear leg was moved by dragging it over the ground at the end of a chain.

Results of Tests with Steel Anchors

The ability of a tower to resist loads depends chiefly on the anchors steadying it. Foundation anchors, it was pointed out in Mr. J. B. Leeper's paper, must resist



TWO TYPES OF FOUNDATION FOOTINGS

horizontal as well as vertical forces. On account of the variability of the character of soil, declared the author, it seems that anchors should be designed for greater overloads than towers. From the results of tests presented in the paper, it appears that assumptions different from those usually adopted should be made in figuring the resistance of anchors to displacement. This

was suggested since the earth over a newly made anchor does not become bonded together as firmly as undisturbed earth before the towers are required to carry a load. Although the load is usually slightly greater on foundations in compression than on footings for the same tower in tension, resistance to uplift is the chief requisite of anchors. Attention was called to the fact that the failure of many towers has been caused by the stubs being unable to resist horizontal forces, thereby shifting and allowing the legs to buckle. Horizontal struts near the tower feet will preserve the spacing of the legs but will tend to cause buckling of the stubs.

Towers and Foundations Used by Alabama Power Company

In a paper presented by Mr. W. E. Mitchell there were outlined the conditions assumed in designing the foundations for the transmission towers of the Alabama Power Company. The maximum wind load assumed for conductors was 8 lb. per square foot of projected area and 16 lb. per square foot for flat surfaces. The probable thickness of ice deposits was taken as ¼ in., since sleet storms are practically unknown in the vicinity of the line. In determining the size of footings and the depth at which they should be buried it was assumed that the resistance to uplift would be equal to the weight of an inverted truncated cone of earth whose lower base had an area equivalent to that of the anchor plate and whose surface was inclined 30 deg. to the axis.

Hand drills, coal augers, a portable gasoline-engine-driven air compressor with a jack-hammer drill, and 40 per cent dynamite, were employed in excavating. The coal augers were not satisfactory, but air drilling was 25 per cent cheaper than hand drilling. Gasoline-engine-driven tampers gave good results but were difficult to transport in rough country. An average of twelve to sixteen towers was assembled and erected in a day. Excavating, setting footings and backfilling with all-steel foundations cost, on the average, $28 per tower. Assembling 4800-lb. towers cost $10, and erecting cost $5.

Testing, Erecting and Protecting Towers

In Mr. P. M. Downing's paper on "Tower Foundations" it was pointed out that the most reliable method of determining the stability of a tower is by actual test. It was suggested that a wind pressure of 14.25 lb. per square foot on flat surfaces with a temperature range of 125 deg. Fahr., or a pressure of 21 lb. per square foot under ordinary temperatures, be assumed in designing towers which are not likely to be subjected to severe snow and sleet.

Metal footings may have sufficient resistance to uplift, but they were not recommended, for too often they have proved inadequate. Under no circumstances, declared the author, should single-post footings be used. Two or three posts are more rigid and substantial, but of course more expensive. There is hardly enough difference between the first costs of concrete and all-metal footings to justify using the latter. The cost of constructing footings for 75-ft. to 80-ft. towers supporting 800-ft. spans was given as follows: Labor, $40; material, $16, and hauling material, $34—making a total of $90 per tower. These figures were based on labor at $2.50 to $3 a day, mixing concrete by hand, and hauling material 6 to 8 miles.

The gin-pole method of erecting towers was recommended. With this method a triple-guyed 30-ft. to 35-ft. gin pole is placed just outside the footings to support an open sheave, over which a 0.5-in. flexible steel cable is run from just below the cross-arms of the tower to a triple-block tackle anchored 300 ft. to 400 ft. from the base of the tower. It was stated that the tower, being raised, need not be side-guyed unless there is a strong wind, but the feet should be restrained from shifting during erection. With this equipment nine men and a 3-ton motor truck can raise and fasten nine towers in eight to nine hours.

Mr. Downing recommended protecting towers from corrosion by the hot-dip galvanizing process, as painting is more expensive and less desirable in the long run. Galvanized tower bolts are not entirely satisfactory, he declared, and sherardized products soon lose their protective coating when exposed to the weather. It was pointed out that unless tower bolts are tightened within a few months or a year after erection the rigidity of the tower may be impaired by virbration caused by the wind.

Towers and Footings Used by Toronto Power Company

Several types of towers used on the 66,000-volt lines of the Toronto Power Company, and the corresponding footings, were described in the paper by Mr. F. C. Connery. Where the towers had to be erected in low marshy land, 2-in. plank sheathing was driven around each tower-leg stake, the muck dug out, and a floating foundation made of 2-in. impregnated planks built 6 ft. below the surface. About 1 cu. yd. of concrete was then placed beneath and around each stub. These have neither settled nor shifted in one year.

Discussion

In a written communication Mr. Ralph D. Mershon of New York gave considerable data relating to tower settings.

In reply to a question by Prof. H. V. Bozell of Norma, Okla., Mr. Leeper stated that the three-leg concrete post arrangement is unsatisfactory by reason of the excessive twisting stresses to which the cross-arms may at times be subjected.

Four Years' Operating Experience with a High-Tension Line

A record of the observations made by the Pennsylvania Water & Power Company during four years' operation of its 10,000-volt Baltimore-Holtwood transmission line was presented for discussion by Mr. A. Bang. This record related chiefly to the effect of lightning flashovers, deterioration of insulators, and effect

OPERATING RECORD FOR HOLTWOOD-BALTIMORE TRANSMISSION LINE, JAN. 1, 1911, TO DEC. 31, 1914

Cause	1911			1912			1913			1914			Total for Four Years		
	T.I.	P.I.	V.D.	T.I.	P.I.	V.D.	T.I.	P.I.	V.D.	T.I.	P.I.	V.D.	T.I.	P.I.	V.D.
Lightning	23	..	10	3	19	4	3	17	11	1	6	7	30	42	32
Defective insulators	..	..	..	..	..	..	1	..	..	..	1	1	1	1	1
Sleet on cables	..	..	..	..	..	..	..	..	..	2	2	..	2	2	..
Birds on line	1	..	..	..	..	..	1	..	2	1	3	2	3	3	4
Wires blowing together	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1

of sleet on conductors, and the author suggested various means of preventing disturbances from these causes.

Service interruptions occurring on the line are classified in the accompanying table according to cause and seriousness, "T. I." meaning total interruptions, "P. I." partial interruptions, and "V. D." voltage disturbances with no interruptions. When insulator flashovers occurred usually the lower three units were broken to pieces, probably from the heat in the arc as indicated by the deep burn on the bottom bolt. From pits or

burned spots on the conductors it was concluded that arcs are generally blown away from the generating station by magnetic repulsion.

As shown by the chart, interruptions due to lightning were reduced after 1911. This was done by using seven disks in the suspension strings instead of six, and eight disks in the strain insulators instead of seven. After the change was made it was observed that flashovers occurred between the conductors and the cross-arms beneath them, instead of around the insulators. This condition was found preferable as arcs following this path were not so likely to damage the insulators. Furthermore, fewer three-wire short-circuits were likely to occur, as the lower conductors were farther from any ground.

From the maintenance point of view, Mr. Bang declared, deterioration of porcelain insulators is very serious, as some units which outwardly appear satisfactory have been found by meggers to be useless. From tests of insulators which have been in use three years on the Baltimore-Holtwood line, it was found that about 7.3 per cent of the disks had a resistance below 500 megohms. Tests made about six months after these units were replaced indicated that 4.7 per cent more had deteriorated, showing that porcelain deteriorates at a rapidly increasing rate. Other observations showed that horizontal strain insulators deteriorate more rapidly than suspension units, and disks near the cross-arms appear to fail more quickly than those near the conductors. The relation between insulator resistance (as measured by a megger) and puncture voltage was shown in the form of a curve.

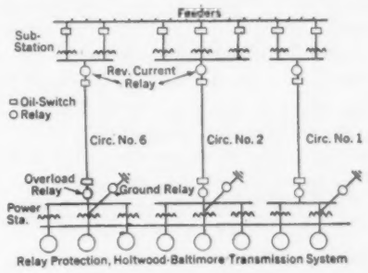
To study the cause of insulator break-down, the pins, caps and cement of insulators shown to be weak by megger tests were dissolved in a solution of nitric and hydrochloride acid so that the porcelain structure was exposed. Minute cracks were found in many of these insulators, but others showed no outward defects. The cracks, Mr. Bang declared, were probably caused by unequal heating, crystallization of the cement, etc. The low resistance of insulators showing no defects was ascribed to porosity or lack of vitrification, both of which allow moisture to enter the porcelain. It was pointed out that the cracks which were found would not have been detected by testing the mechanical strength of the insulators since they were as strong as those containing no defects.

To minimize the trouble resulting from sleet collecting on wires, the conductors on the Baltimore-Holtwood line have been staggered to prevent their coming in contact with each other. Every fifth tower is designed to anchor the spans on each side so that the effect of mechanical failures will not extend for any great distance. Another method which has been employed to prevent trouble from sleet collecting on the wires is to circulate enough current through each wire so that sleet cannot stick to the cables. Experience has shown that 250 amp. to 300 amp. is sufficient in aluminum wires having a cross-section of 300,000 circ. mils. To prevent buzzards grounding circuits when alighting on cross-arms or poising for flight therefrom, the minimum from wire to ground has been made 47 in.

In order to maintain continuous operation when disturbances do occur, use is made of interlocking relays, Nicholson arc extinguishers and Ricketts field de-energizers. The relays are connected as shown in the accompanying diagram. All of them are made to act instantaneously but operate their respective oil switches through definite-time relays set for various time intervals (0.75 second to 3 seconds) so a momentary short-circuit will have no effect. To prevent all circuits being disconnected simultaneously, the trip circuits are interlocked.

It was found that in order to make the arc suppressor operate satisfactorily correctly timed fuses had to be used. If the fuses rupture too quickly the arc may be re-established, whereas if they take too long to burn out the synchronous machines may drop out of step. As a check on the time required to blow fuses, cycle recorders were connected between them. The suppressors are connected with the line only when lightning storms are expected so the fuses will not be blown by short-circuits on the low-tension system. In 1913 and 1914 this equipment cleared trouble twenty-five out of forty times when the lightning struck the line.

The field destroyer and restorer relays are set to act more slowly than the arc-extinguisher relays and the



LOCATION OF LINE RELAYS

interlocking relays, so the latter will have first chance to clear the trouble. The field destroyer and restorer device is set to disconnect all generator fields whenever an arcing ground occurs and then re-energizes them after 1.5 seconds have elapsed. The Nicholson arc suppressor is given the first opportunity of extinguishing the arc because of its quickness in acting, which prevents severe damage. The field destroyer, however, extinguishes the arc with more certainty.

Discussion

Among those who participated in the discussion were Messrs A. S. McAllister of New York, E. E. F. Creighton of Schenectady, E. A. Lof of Schenectady, and L. C. Nicholson of Buffalo.

Dr. McAllister called attention to the fact that the insulators for a certain line in Japan had been found to deteriorate with equal rapidity whether they were in service on the line or kept in stock in the storage room, thereby showing that the predominating part of the deterioration is not attributable to electrical stresses or mechanical vibrations.

Professor Creighton stated that Mr. Bang had discovered a 10 per cent greater deterioration in the insulation upon an active line than in those on a reserve line seldom placed in service. The major part of the deterioration is doubtless attributable to differences in the expansion coefficients of the iron pin and the porcelain. He said that use may yet be made of the cementless type of disk insulator, which was the type just introduced but soon abandoned.

Mr. Lof outlined certain tests made upon a 70,000-volt line in Sweden on which use is made of disk insulators of graded capacity arranged six in series to divide the potential in such a way that the drop across any one disk is not less than 15 per cent nor more than 20 per cent. When uniform disks were tested the potential drop varied from 11 to 30 per cent per disk, thereby subjecting one disk to nearly double the average pressure drops.

Mr. Nicholson reported the result of observations made on 40,000 insulators which had been in service for one year. The loss by depreciation was 2.5 per cent. Of the depreciated insulators 90 per cent failed by reason of cracks produced at the cap by temperature changes.

Life-Testing Equipment for Tungsten Lamps

Interesting Electrical Features of the Incandescent Lamp-Testing Laboratory at Nela Park, Cleveland

WHEN an engineer sets himself to the task of designing an elaborate electrical distribution system in which no voltage variations of greater magnitude than one-tenth of 1 per cent are to be allowed, it is to be expected that some unusual electrical construction will result. Very few lines of work require voltage to be held within such narrow limits, but in the accurate testing of incandescent lamps potential precision is regarded as a prime essential. Therefore when the new life-testing equipment was to be designed for the National Lamp Works of the General Electric Company at Nela Park, Cleveland, precedent in distribution-system design was disregarded, and with the two watchwords—precise voltage regulation and economical construction—as the guiding factors an installation full of unique and original ideas was worked out.

Electrical energy for testing purposes comes from the 11,000-volt service lines of the Cleveland Electric Illuminating Company. After traversing a step-down substation in which the potential is reduced to 440 volts, the energy is used to drive two three-phase synchronous motors which are directly connected to two 120-volt alternators of 200-kw and 300-kw rating. These motor-generators are installed in the basement of a five-story building, and the switchboard from which the machines are controlled, together with the testing equipment itself, is installed on the fifth floor, some 60 ft. above.

Telephone Helps Solve a Remote-Control Problem

Remote control for the synchronous motor-generator sets might in this case have appeared most logical at first. But careful cost calculations showed conclusively that it would be much less expensive to install a double run of heavy copper for control circuits from the machines to the switchboard than to purchase remote-control apparatus. It is quite true that the machines are not within the range of the eyes or ears of the operator, but, analyzing the actions of an operator, the engineers observed that a man starting a machine keeps his eyes on the switchboard instruments and perceives that the machines are "picking up" properly through his sense of hearing. Consequently, to reproduce as nearly as possible duplicate conditions with the existing circumstances the manually operated switches and the instruments for the motor-generators were installed in the switchboard rooms on the fifth floor. To enable the

FIG. 1—RADIAL DISTRIBUTION SYSTEM IN INCANDESCENT-LAMP TESTING LABORATORY

operator to tell whether or not the machines are starting when he closes the switch a telephone transmitter has been installed on the frame of each set, and from the transmitter a circuit has been run to the lower portion of the motor-generator control panel where it terminates in a standard telephone jack (Fig. 6). Just above the jack is a miniature signal lamp. An operator starting one of the motor-generators puts on a head-type telephone receiver and places a plug attached to the receiver cord in the jack. If the telephone circuit is in operating condition, the miniature signal lamp glows, and then the operator closes the starting switch and watches the switchboard instruments. Through the telephone he hears the machines attaining synchronous speed and thus knows that everything is operating properly. As a safety measure the motor-generators in the basement are placed in a screened compartment.

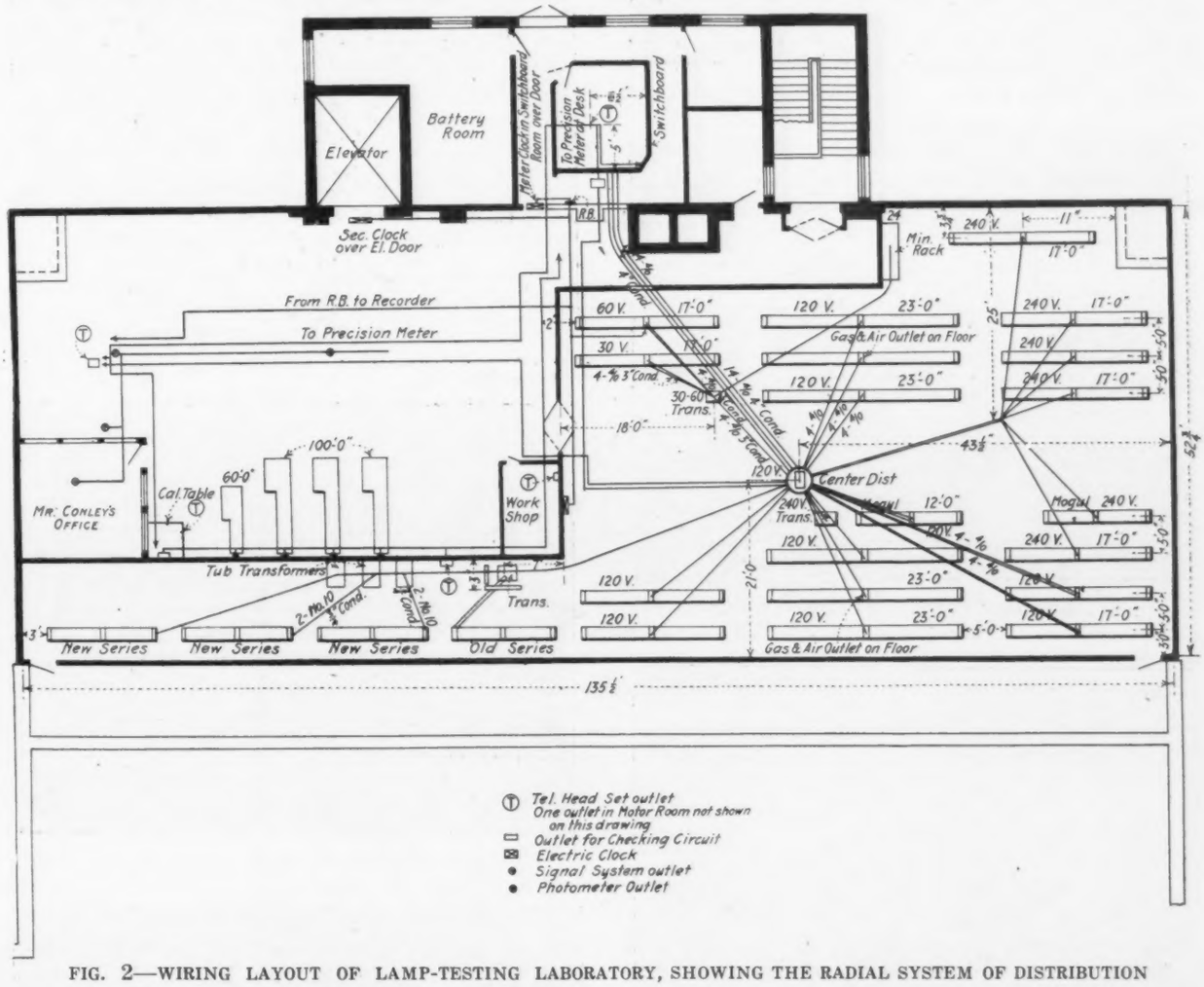


FIG. 2—WIRING LAYOUT OF LAMP-TESTING LABORATORY, SHOWING THE RADIAL SYSTEM OF DISTRIBUTION

Extent of Measures to Secure Constant Potential

Ordinarily the load on these machines averages 150 kw and the maximum load is 250 kw. Operating on circuits of constant frequency, the speed of the synchronous motors is practically constant, and hence the voltage produced by the generators varies less than does the potential of commercial circuits. The flywheel effect of the set also tends to reduce any fluctuation due to varying load. The 120-volt energy from the generator is conducted through the switchboard and to a center of distribution in the test-rack room. From a 120/240-volt auto-transformer on the floor near the center of distribution 240-volt leads rise to a second center to supply energy for the comparatively small 240-volt load.

No effort has been spared to insure the maintenance of a constant potential, 120.1 volts, at the distribution circle. Two Tirrill regulators, one of standard and one of special type, have been installed on a special panel in the switchboard room and have been wired so that either regulator may be used with either or both motor-generators to maintain constant potential at the circle. The correct voltage at the circle is constantly indicated by a voltmeter inlaid beneath a pane of glass in the top of the operator's desk. By observing this instrument and turning the rheostat handle, shown in the desk near it, the operator can vary the current through a shunt which has been connected around the main voltage-control coils of the Tirrill regulators, and thus adjust the voltage to the desired value at the circle. A special over-voltage relay on the same panel with the regulators is set so that it will trip the main circuit-breakers if the potential rises one volt or more above 120.1 volts. To insure continuity of accuracy the desk voltmeter is calibrated with a potentiometer once each day.

Electrical System and Timing System Interlocked

Accurate timing is also essential in making life tests on lamps; therefore a device has been installed which will stop all time clocks if the supply of energy to the lamps on test should be interrupted. Primarily the timing system is controlled by a Stromberg master clock, which in addition to performing its regular duties as a master clock closes the secondary circuit of a time relay every thirty-six seconds. This circuit also runs to the

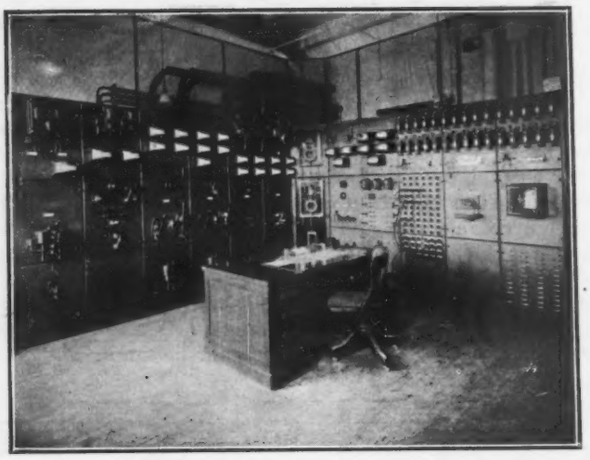


FIG. 3—A SWITCHBOARD THAT EMBODIES MANY NOVELTIES

FIG. 4—GROUP IN THE PHOTOMETER ROOM

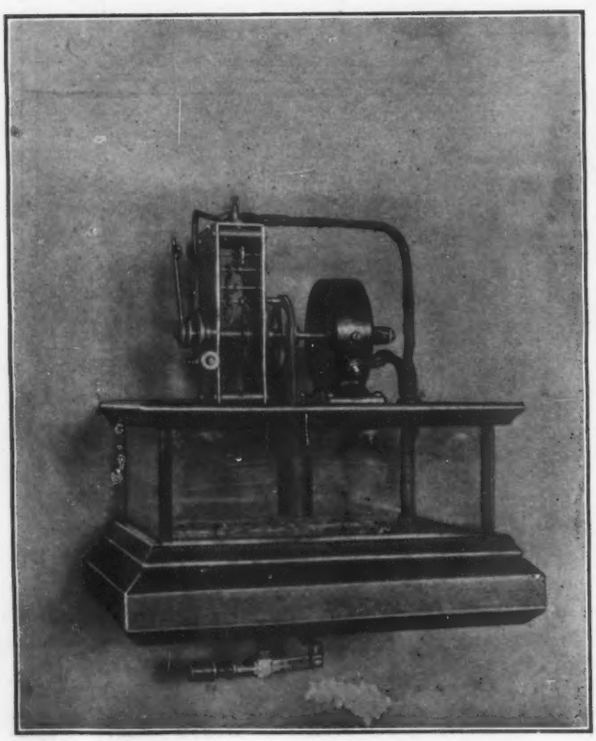


FIG. 5—THE INSTRUMENT THAT WARNS OF INTERRUPTIONS

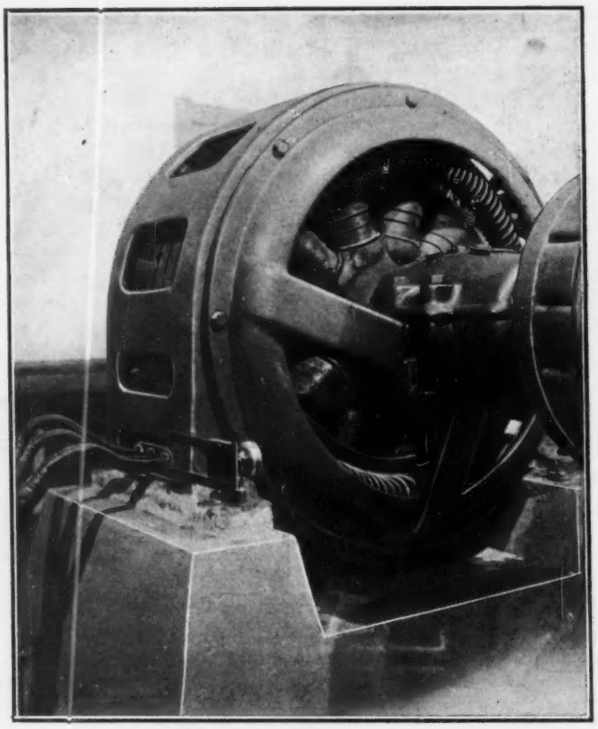


FIG. 6—THE TELEPHONE REPORTS STARTING OF MACHINE

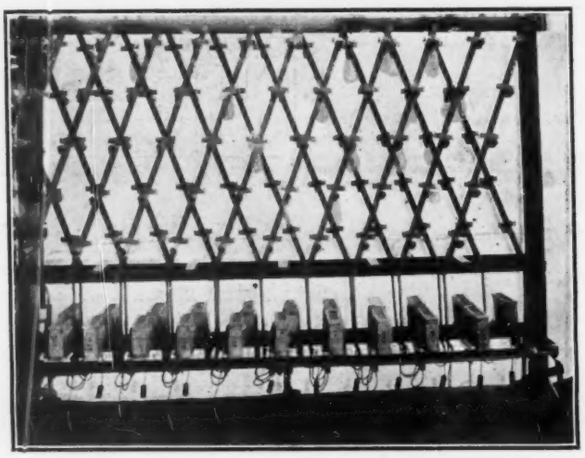
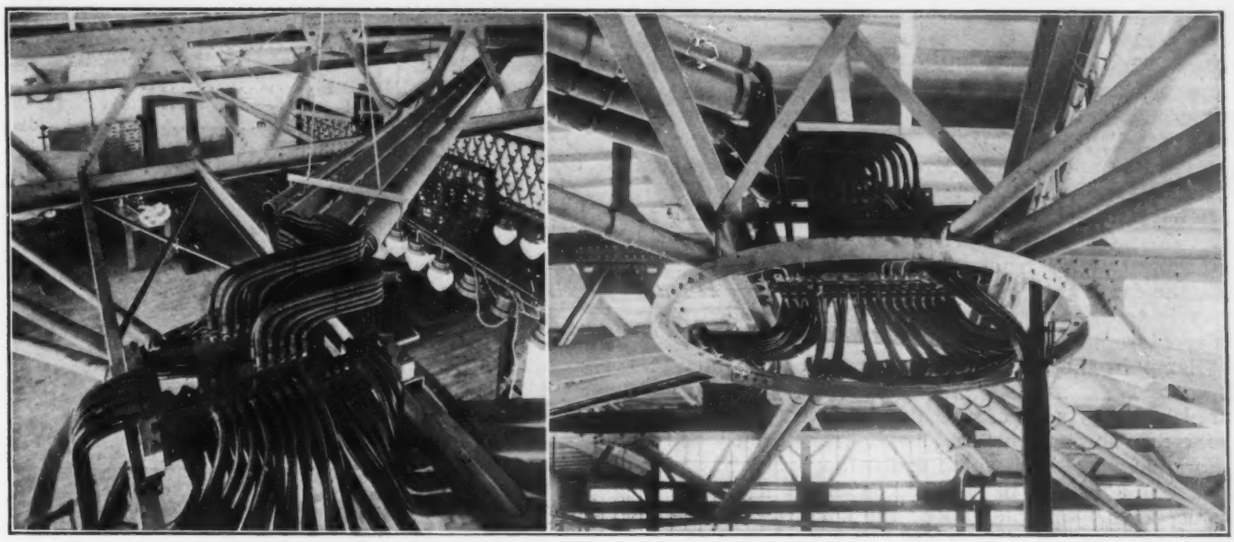


FIG. 7—LAMP RACK WITH SMALL AUTO-TRANSFORMERS

FIG. 8—PREPARING LAMPS FOR THE TEST-RACK ROOM

rack room, and there is connected to a time counter and to a chronograph recording time at 0.01 hour intervals.

The device for stopping these time recorders is unique. It consists, as shown in Fig. 5, of a gravity-operated clock and a toy motor the construction of which has been altered somewhat. The weight attached to the clock part of the instrument drives a worm-and-gear mechanism which tends to close the electrical contact at the left of the instrument once every thirty-eight or forty seconds. But as long as the timing system is in proper working order the instrument receives an impulse every thirty-six seconds through the time relay which is actuated by the master clock. The impulse which the motor receives is just sufficient to cause it to rewind the gravity clock and prevent the electrical contacts at the left of the device from being closed. In this way the two units are continually working in opposition to each other, the gravity clock tending to close the contacts and the motor tending to keep them open. Failure of the timing system prevents the motor from receiving its regular impulse and allows the contacts to close. The closing of these contacts opens the main circuit-breaker and thus prevents the test lamps being operated for more than thirty-six seconds after the timing system has ceased to count the time of operation.



FIGS. 9 AND 10—DETAIL VIEWS OF THE "CIRCLE" DISTRIBUTING CENTER AS SEEN FROM ABOVE AND FROM BELOW

Radial Distribution Gives Convenience and Economy

After taking all of these precautions to insure accurate timing and continuous and steady energy supply at the circle it was necessary for the designers to lay out an economical distribution system which would deliver the energy to each of the racks at exactly the same potential, so that data from tests made on different racks would be reliable and easy to compare with other test data.

The radial system of distribution which was adopted is in itself unusual. From the circle, as the center of distribution is called, a separate set of leads are run in a straight line to the middle point of each rack. The amount of copper in each of these separate radial lines has been so apportioned that the potential drop between each rack and the circle is 0.1 volt under normal load conditions. Hence the potential at each of the racks is exactly 120 volts. To give an idea of the amount of copper needed to supply each rack with an individual feeder it may be said that in the leads from the circle to the racks 1750 lb. of copper, or the equivalent of 70 miles of No. 18 wire, was used.

To have installed any other than a radial system of distribution with a uniform standard of 0.1 volt drop to each rack would have been much more costly. The amount of conduit needed would have been greater by the factor $\sqrt{2}$, or 1.41. The amount of copper needed would have been approximately twice that needed for the radial system, because in addition to the added length there would have needed to be greater cross-section to reduce the drop occasioned by the increased length. More time would have been needed to install any other system. Considering future additions the radial system presents the least difficulties because none of the existing lines will be in the way of others which it may be necessary to install later. At present the lines emanating from this circle serve about 9000 lamp-test sockets.

A "Kink" in Connector Design

It is necessary to do lamp testing at many potentials other than 120 volts. To provide the desired range of voltages portable 0.75-kw auto-transformers are used. With these and larger transformers all pressures from 6 volts to 300 volts can be obtained in one-volt steps. To connect the small compensators auto-transformers to the line and to the portion of the rack which they are to serve tapered plugs and fiber-insulated sockets are employed. In preparing the connectors the question arose as to whether it would be better to have the connections made by slipping the insulated sockets down over upward-protruding plugs or by pushing the insulated sockets upward over depending vertical plugs. With the auto-transformers in their positions at the base of the racks either method could have been used. However, the connectors were installed with the plugs extending vertically downward, so that to make a connection an operator must grasp the insulated socket, shown hanging beneath the racks in Fig. 7, and force it upward over a tapered plug. If the contact is hurriedly and poorly made, the socket drops off entirely and the open circuit is noticed at once. Experience has shown that the little study which was given to the mechanics of plugging enabled the designers to provide a system in which the operators always get either good contacts or no contacts at all. Troubles caused by poor contacts have been eliminated. This flexibility

is of advantage because it permits economic operation. A transformer that is not in actual service can be disconnected by removing one connector, and hence the no-load losses are eliminated. The resultant saving in this case amounts to about $20 a month.

Miniature Lamp-Testing Rack Presents a Special Problem

In addition to the racks used for testing the common varieties of multiple incandescent lamps, special racks have been installed for testing the large series units and the miniature lamps. In appearance the series racks are very much like the multiple racks shown in Figs. 1 and 7. Constant-current transformers are used with the series racks, however, instead of the 0.75-kw auto-transformers.

The construction of the racks for miniature lamps is unique. On account of the low potential at which these tiny lamps operate, the problem of voltage drop in the racks, leads and sockets themselves becomes of importance. The conductors which feed energy to the lamps were made, therefore, to act as sockets also. To enable the conductors to accomplish this dual duty they are constructed of heavy brass strips. The strips forming the positive and the negative conductors are mounted vertically, and, although well insulated from each other, they have been installed with the faces of the two strips very close together. The front strip has been drilled and tapped with threads of the proper size to accommodate the candelabra base of a miniature lamp. When a lamp is screwed home in one of these threaded holes its end terminal touches the rear plate, thereby placing the lamp in the circuit between the positive and the negative brass strips. The rack contains 300 miniature lamp sockets, all of which are fed with energy from the circle through a 120/60-volt transformer and a set of balancer coils which enable any potential from 1 volt to 60 volts to be obtained on the rack.

One other item, a detail of the construction of the test room itself, is interesting. The glass used in the windows is a German product called "multiflora." Ordinary glass in the windows, the engineers thought, would allow individual light sources to be seen plainly from without at night and produce an unsightly appearance. Common types of more or less dense diffusing glass were considered unsatisfactory because of the fact that they would return a considerable percentage of the radiant energy into the room. The multiflora, however, returns very little of the radiant energy to the room, and at night shows a fairly even glow over the window surfaces without revealing the presence of any individual lamp.

The design of this life-testing equipment for the National Lamp Works of the General Electric Company was carried out by Mr. Evan J. Edwards, associate engineer for the company, and his assistants.

Cost Data on 6600-Volt Lines

The data here tabulated, which were taken from a paper on distribution conditions presented at the recent convention of the N. E. L. A. by Mr. J. C. Martin, relate to two 6600-volt rural-service lines now in operation in the State of Washington. The first case is that of a line about 17.5 miles long, on which there are thirty-two telephone and railway crossings, and the second case is that of a line about 14.5 miles long, on which there are nine telephone and railway crossings. These lines were built with the expectation of developing new business in the future and with the knowledge that the return in the first few years of their life would perhaps not be sufficient to pay all charges.

The figures shown, it will be noted, do not take into account the cost of energy lost between power house and customer. The accompanying figures, therefore, show a loss that is less than the actual loss. The losses shown in these cases, it is stated, are typical of those that are likely to be sustained in the early life of very many similar lines in the rural territory of Western States.

TABLE I—COST DATA FOR 17.5-MILE, 6600-VOLT LINE—THIRTY-TWO CROSSINGS

Actual cost of line	$26,463.00
Additional cost for crossing construction, 1911 N.E.L.A. specifications	2,553.28
Total	$29,016.28
Actual annual revenue	$4,350.35
Operation and fixed charges:	
(a) Line as built:	
Depreciation (average 5.2 per cent)	$1,378.15
Operating	948.86
Maintenance	194.94
Taxes	105.63
Interest, 8 per cent	2,117.04
Total operating cost for year	$4,744.62
Loss per year	$394.27
Loss in per cent of actual cost of line	1.49
Loss in per cent of annual revenue	9.10
(b) With crossing construction included:	
Depreciation	$1,531.35
Operating	948.86
Maintenance	194.94
Taxes	105.63
Interest, 8 per cent	2,321.30
Total operating cost for year	$5,102.08
Loss per year	$751.73
Loss in per cent of actual cost of line, plus crossing construction costs	2.6
Loss in per cent of annual revenue	17.3
Number of crossings	32
Total estimated cost of crossing construction	$2,533.28
Average cost per crossing	$79.79

TABLE II—COST DATA FOR 14.5-MILE, 6600-VOLT LINE—NINE CROSSINGS

Actual cost of line	$18,829.00
Additional cost for crossing construction, 1911 N.E.L.A. specifications	886.86
Total	$19,715.86
Actual annual revenue	$3,727.45
Operation and fixed charges:	
(a) Line as built:	
Depreciation (average 5.35 per cent)	$1,006.31
Operating	1,006.95
Maintenance	245.20
Taxes	90.77
Interest	1,506.32
Total operating cost per year	$3,855.55
Loss per year	$128.10
Loss in per cent of actual cost of line	0.68
Loss in per cent of annual revenue	3.44
(b) With crossing construction included:	
Depreciation	$1,069.48
Operating	1,066.95
Maintenance	245.20
Taxes	90.77
Interest	1,577.27
Total operating cost	$4,049.67
Loss per year	$322.22
Loss in per cent of actual cost of line, plus crossing construction costs	1.63
Loss in per cent of annual revenue	8.65
Number of crossings	9
Total estimated cost of crossing construction	$886.86
Average cost per crossing	$98.54

Voltage and Current Relations in Open-Delta-Connected Transformers

BY B. F. JAKOBSEN

Fig. 1 represents two transformers A and B joined in "open-delta" and connected to a load made up of three impedances Z_1, Z_2 and Z_3, the line impedances being respectively Z_a, Z_b and Z_c, and the equivalent impedances of the two transformers (referred to their secondaries, and exciting currents neglected) being Z_{aa} and Z_{bb}. Let E_{aa} and E_{bb} be the primary impressed voltages on the two transformers (reduced to the sec-

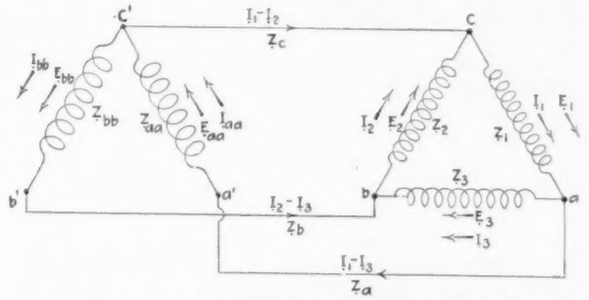


FIG. 1—OPEN-DELTA CONNECTED TRANSFORMERS AND LOAD

ondary turns) and let I_1, I_2 and I_3 be the three load currents. The general problem is to find these three load currents when the two voltages E_{aa} and E_{bb} and the several impedances are given. When the load currents have been found, the transformer currents and the load voltages may be readily calculated, as shown below.

In Fig. 1 the arrows indicate the directions which are taken as the positive directions of the voltages and currents represented by the symbols placed beside them. The emf acting around any closed loop is always equal to the vector sum of the impedance drops around this loop; this is merely Kirchoff's second law applied to alternating currents. Hence, applying this law to the three loops, *a'c'ca*, *c'b'bc* and *abc*, and placing a dot under the various symbols to indicate that their vector values are to be taken, the following equations result:

$$\dot{E}_{aa} = (\dot{Z}_1 + \dot{Z}_c + \dot{Z}_a + \dot{Z}_{aa})\dot{I}_1 - \dot{Z}_c\dot{I}_2 - (\dot{Z}_a + \dot{Z}_{aa})\dot{I}_3. \quad (1)$$

$$\dot{E}_{bb} = -\dot{Z}_c\dot{I}_1 + (\dot{Z}_2 + \dot{Z}_c + \dot{Z}_b + \dot{Z}_{bb})\dot{I}_2 - (\dot{Z}_b + \dot{Z}_{bb})\dot{I}_3. \quad (2)$$

$$0 = \dot{Z}_1\dot{I}_1 + \dot{Z}_2\dot{I}_2 + \dot{Z}_3\dot{I}_3. \quad (3)$$

Solving equation (3) for $\dot{I}_3$ and substituting in (1) and (2) gives

$$\dot{E}_{aa} = \dot{M}_1\dot{I}_1 + \dot{N}_1\dot{I}_2, \quad (4)$$

$$\dot{E}_{bb} = \dot{N}_2\dot{I}_2 + \dot{M}_2\dot{I}_2, \quad (5)$$

where

$$\dot{M}_1 = \dot{Z}_1 + \dot{Z}_c + \dot{Z}_a + \dot{Z}_{aa} + \frac{\dot{Z}_1}{\dot{Z}_3}(\dot{Z}_a + \dot{Z}_{aa}), \quad (6)$$

$$\dot{M}_2 = \dot{Z}_2 + \dot{Z}_c + \dot{Z}_b + \dot{Z}_{bb} + \frac{\dot{Z}_2}{\dot{Z}_3}(\dot{Z}_b + \dot{Z}_{aa}), \quad (7)$$

$$\dot{N}_1 = \frac{\dot{Z}_2}{\dot{Z}_3}(\dot{Z}_a + \dot{Z}_{aa}) - \dot{Z}_c, \quad (8)$$

$$\dot{N}_2 = \frac{\dot{Z}_1}{\dot{Z}_3}(\dot{Z}_b + \dot{Z}_{bb}) - \dot{Z}_c. \quad (9)$$

Solving equations (4) and (5) for $\dot{I}_1$ and $\dot{I}_2$ gives

$$\dot{I}_1 = \frac{\dot{M}_2\dot{E}_{aa} - \dot{N}_1\dot{E}_{bb}}{\dot{M}_1\dot{M}_2 - \dot{N}_1\dot{N}_2}. \quad (10)$$

$$\dot{I}_2 = \frac{\dot{M}_1\dot{E}_{bb} - \dot{N}_2\dot{E}_{aa}}{\dot{M}_1\dot{M}_2 - \dot{N}_1\dot{N}_2}. \quad (11)$$

From (3) the third load current is then

$$\dot{I}_3 = -\frac{\dot{Z}_1\dot{I}_1 + \dot{Z}_2\dot{I}_2}{\dot{Z}_3}. \quad (12)$$

The transformer currents are then

$$\dot{I}_{aa} = \dot{I}_1 - \dot{I}_3 \quad (13)$$

$$\dot{I}_{bb} = \dot{I}_2 - \dot{I}_3, \quad (14)$$

and the load voltages are

$$\dot{E}_1 = \dot{Z}_1\dot{I}_1; \qquad \dot{E}_2 = \dot{Z}_2\dot{I}_2; \qquad \dot{E}_3 = \dot{Z}_3\dot{I}_3. \quad (15)$$

The above formulas are perfectly general. Usually the transformer impedances are equal, the line impedances are equal, and the load impedances are equal; that is, $\dot{Z}_{aa} = \dot{Z}_{bb}$; $\dot{Z}_a = \dot{Z}_b = \dot{Z}_c$; and $\dot{Z}_1 = \dot{Z}_2 = \dot{Z}_3$. When these relations hold, then

$$\dot{M}_1 = \dot{M}_2 = \dot{Z}_1 + 3\dot{Z}_a + 2\dot{Z}_{aa}, \quad (16)$$

$$\dot{N}_1 = \dot{N}_2 = \dot{Z}_{aa}, \quad (17)$$

$$\dot{I}_3 = -(\dot{I}_1 + \dot{I}_2), \quad (18)$$

which greatly simplify the calculations.

Example 1.—Two 55,000-volt transformers are connected open-delta and supply power to a non-inductive three-phase delta-connected load having an equivalent resistance per phase of 5240 ohms. Neglecting the transformer and line impedances, what will be the current in each transformer, assuming the transformer voltages equal and 120 deg. apart in phase?

From (16) and (17),

$$\dot{M}_1 = \dot{M}_2 = 5240.$$

$$\dot{N}_1 = \dot{N}_2 = 0.$$

Taking $\dot{E}_{aa}$ as the reference vector and assuming $\dot{E}_{bb}$ to lag 120 deg. behind $\dot{E}_{aa}$,

$$\dot{E}_{aa} = 55{,}000.$$

$$\dot{E}_{bb} = -55{,}000\left(\frac{1}{2} + j\frac{\sqrt{3}}{2}\right).$$

From (10), (11) and (12),

$$\dot{I}_1 = \frac{55{,}000}{5240} = 10.5.$$

$$\dot{I}_2 = -\frac{55{,}000}{5240}\left(\frac{1}{2} + j\frac{\sqrt{3}}{2}\right) = 10.5\left(-\frac{1}{2} - j\frac{\sqrt{3}}{2}\right).$$

$$\dot{I}_3 = -10.5\left(1 + \frac{1}{2} + \frac{\sqrt{3}}{2}\right) = 10.5\left(-\frac{1}{2} + j\frac{\sqrt{3}}{2}\right).$$

The load currents are therefore equal in effective value (10.5 amp) and differ in phase by 120 deg. From (14) and (15),

$$\dot{I}_{aa} = 10.5\left(1 + \frac{1}{2} - j\frac{\sqrt{3}}{2}\right) = 10.5\sqrt{3}\left(\frac{\sqrt{3}}{2} - j\frac{1}{2}\right).$$

$$\dot{I}_{bb} = 10.5\left(-\frac{1}{2} - j\frac{\sqrt{3}}{2} + \frac{1}{2} - j\frac{\sqrt{3}}{2}\right) = 10.5\sqrt{3}\left(0 - j\right).$$

Each transformer current is therefore equal in effective value to $\sqrt{3}$ times the load current per phase, and the current in transformer A lags behind voltage of this transformer by the angle $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right) = 30$ deg., and the current in transformer B leads the voltage of B by

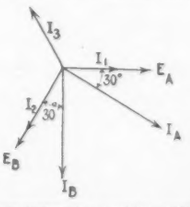


FIG. 2—RELATION BETWEEN LINE CURRENT AND TRANSFORMER CURRENT AND VOLTAGE

120 deg. — 90 deg. = 30 deg. (see Fig. 2). From (15) the three load voltages are equal in effective value ($10.5 \times 5240 = 55{,}000$ volts) to the effective value of the voltage of either transformer, and differ in phase by 120 deg. The total transformer volt-amperes is $2 \times 55{,}000 \times 10.5\sqrt{3}$, and the total volt-amperes taken

by the load is $3 \times 55{,}000 \times 10.5$. Hence the volt-ampere capacity of the transformers must be $\frac{2 \times \sqrt{3}}{3} = 1.155$ times the volt-amperes taken by the load; i. e., 15.5 per cent more transformer capacity is required when two transformers are connected in open delta than would be required with three transformers connected in a closed delta.

Example 2.—Same as example 1 except that the impedances of the transformers are taken into account, these impedances being equal and having the value

$$\dot{Z}_{aa} = \dot{Z}_{bb} = 24.5 + j118.5.$$

The line impedances are neglected and the three load impedances are non-inductive and each equal to 5240, viz.,

$$\dot{Z}_a = \dot{Z}_b = \dot{Z}_c = 0.$$
$$\dot{Z}_1 = \dot{Z}_2 = \dot{Z}_3 = 5240.$$

The voltages impressed on the transformer primaries differ in phase by 120 deg., and each has the effective value 55,000; therefore, taking $\dot{E}_{aa}$ as the reference vector and assuming $\dot{E}_{bb}$ to lag behind $\dot{E}_{aa}$

$$\dot{E}_{aa} = 55{,}000.$$
$$\dot{E}_{bb} = -55{,}000(0.5 + j0.866).$$

From equations (17) and (18),

$$\dot{M}_1 = \dot{M}_2 = 5240 + 2(24.5 + j118.5) = 5289 + j237.$$
$$\dot{N}_1 = \dot{N}_2 = 24.5 + j118.5.$$

Therefore

$$\dot{M}_2\dot{E}_{aa} - \dot{N}_1\dot{E}_{bb} = 55{,}000[5289 + j237 + (0.5 + j0.866)(24.5 + j118.5)] = 55{,}000(5198 + j317).$$

$$\dot{M}_1\dot{E}_{bb} - \dot{N}_2\dot{E}_{aa} = -55{,}000[(5289 + j237)(0.5 + j0.866) + 24.5 + j118.5] = -55{,}000(2464 + j4817).$$

$$\dot{M}_1\dot{M}_2 - \dot{N}_1\dot{N}_2 = (5289 + j237)^2 - (24.5 + j118.5)^2 = 27{,}500{,}000 - j2{,}500{,}000.$$

Therefore, from (10) and (11), the first two load currents are

$$\dot{I}_1 = 10.21 - j0.33; \text{ effective value} = 10.21,$$
$$\dot{I}_2 = -5.44 - j8.69; \text{ effective value} = 10.28.$$

From (18) the third load current is

$$\dot{I}_3 = 4.77 + j9.02; \text{ effective value} = 10.20.$$

From (13) and (14) the two transformer currents are

$$\dot{I}_{aa} = 14.98 - j\ 9.35; \text{ effective value} = 17.68,$$
$$\dot{I}_{bb} = -0.67 + j17.71; \text{ effective value} = 17.84,$$

and from (15) the three load voltages, which are in phase with the load currents, since the load is non-inductive, have the effective values:

$$\dot{E}_1 = 53{,}500; \quad \dot{E}_2 = 53{,}900; \quad \dot{E}_3 = 53{,}400.$$

Storing Steam at the Engine Instead of the Boiler

Large receivers and separators were placed near the throttles of reciprocating engines recently installed in the power house of a Western mining company. At the same time the boiler drums installed at the plant were made unusually small, as the company's engineer declared that the proper place to store steam is at the engine throttle and not in the boilers. The receiver capacity at each engine is practically four times the cylinder capacity, and the steam reservoir thus afforded, the engineer stated, permits the use of smaller steam piping, thereby reducing heat losses and establishing at the same time a reserve supply of dry steam immediately at the engine throttle where it is most needed under the condition of an engine engaged in mine hoisting.

Telephone That Tells Who Called While You Were Out

On a single-wire party-line telephone circuit near Constableville, N. Y., each subscriber is provided with a telephone instrument equipped not only with a selective ringing attachment but also with a device to inform the subscriber who, if anyone, called in his absence. The instruments were constructed under specifications covered in a patent issued to Mr. P. G. Bernholtz, Constableville, N. Y. They differ from the standard ground-return telephone in that a special battery has been added to the local circuit and a visual signal or drop, as well as a bell, has been arranged to operate through an especially designed selective-signaling mechanism.

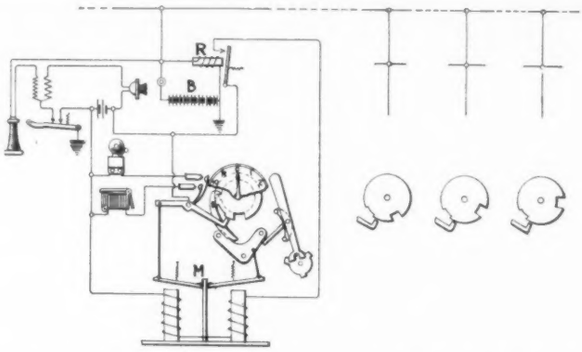


FIG. 1—CIRCUIT DIAGRAM OF PARTY-LINE TELEPHONE

To call a subscriber on a line equipped with these instruments it is necessary to close the special battery (B) circuit through the push-button. The special battery operating all relays (R) on the line unlocks all instruments. The indicator then moves automatically to the desired number, and when the line is again energized the selective-signaling apparatus in the called subscriber's instrument rings the bell and operates the visual signal or drop. Other instruments return to their normal positions. If it so happens that the called party is not within earshot of the bell, he notes on his return that the visual signal has been operated. He then places his indicator on R and energizes the line by means of the special battery, ringing all bells on the line, but failing to actuate any of the visual signals because the indicator was set at position R. Hearing this call and observing that the visual signal has not been disturbed, all subscribers understand the signal, and only the one who previously called and failed to obtain the individual with whom he desired to communicate is supposed to answer.

FIG. 2—CALL-RECORDING TELEPHONE SET

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Protection of Alternators.—A note on a recent British patent (No. 11,436, 1914) of the British Thomson-Houston Company and F. H. Clough for a method of protecting an alternator, in which the armature conductors of one phase are separated from those of another by an earthed shield connected to an automatic circuit-breaker. —London *Elec. Eng'ing*, June 10, 1915.

Lamps and Lighting

Rating and Designating of Incandescent Lamps.—The first part of the stenographic account of the extended discussion which followed the reading of the paper of Salomon recently abstracted in the Digest. The proposals made in that paper originated with the incandescent-lamp manufacturers and were later discussed by the lighting committee of the German Association of Electrical Engineers, but no full agreement had been obtained in that committee. In a communicated discussion by Schneider & Company it was pointed out that the designation of the watt consumption of the lamp is of value only if the ratio of watts to hefners or the ratio of watts to lumens has also been exactly determined and is stated at the same time. N. A. Halbertsman criticised the statement which is sometimes made, that by a special arrangement of a spiral filament it is possible to procure a distribution of light essentially downward. This is not possible, since in a lamp with a complete globe and without a fitting the upper hemispherical candle-power must always be equal to the lower hemispherical candle-power whatever the form or arrangement of the filament. In practice the ratio of the lower to the higher hemispherical candle-power is slightly above unity owing to the fitting on top of the lamp. Greater differences between the upper and the lower hemispherical candle-powers are produced if the upper part of the globe be blackened or provided with a reflector. Klein, who attended the committee meetings for the Association of Central Stations, objected to the proposition that only the watts should be stated and not the candle-power. He urged that it should be required by law to state the voltage, the upper and lower hemispherical candle-powers, the total watt consumption and the watts per candle. Wedding agreed with the proposal of Salomon. He emphasized that it is now possible to measure the total spherical candle-power by means of the Ulbricht spherical photometer. He thought that not only incandescent lamps but also arc lamps should be designated by their total spherical candle-power, although arc lamp manufacturers object to this for good reasons. The bare "2000-cp" tungsten lamp with a lower hemispherical candle-power of 2000 cp has also an upper hemispherical candle-power of 2000 cp. If it is provided with a fitting, the lower hemispherical candle-power becomes 2600 candles. On the other hand, the so-called "2000-cp" arc lamp has a lower hemispherical candle-power of 2000 candles, while the upper hemispherical candle-power is zero. The mean spherical candle-power is 1000 candles. Wedding thought that the mean spherical candle-power should be the general basis of lighting calculations. How any type of lamp is to be used depends, however, also on other factors, such as the height of suspension above the ground, the size of the area to be illuminated, and especially the polar candle-power curve of the lamp, which must be taken into consideration in any case. Blanc objected to the expression "energy consumption in watts." One should say either "power consumption in watts" or simply "watt consumption." Burstyn said that any electrical engineer can measure the watts but not the candle-power of a lamp; but the general public is more vitally interested in the candle-power, and the only exact statement of that would be the total spherical candle-power. The chairman, Passavant, emphasized that when the low hemispherical candle-power was adopted for rating arc lamps the latter were in a class by themselves among electric lamps and were comparable only with compressed-gas incandescent lamps. This is now no longer the case since no distinction can be made between incandescent lamps and arc lamps with respect to size. The report is to be concluded.—*Elek. Zeit.*, May 13, 1915.

Generation, Transmission and Distribution

Electric Power at Blast-Furnace Plants.—J. E. JOHNSON, JR.—In the present instalment of his long illustrated serial on the modern iron blast furnace, the author discusses blast-furnace-plant auxiliaries and general arrangement. After a discussion of the water-supply system he deals with the electrical supply. Where very large electric plants are to be installed it is still a question as to whether the gas engine or the steam turbine is the more economical. The gas engine is undoubtedly the more economical by from 25 to 33 per cent on the heat-unit basis, but its operating cost is decidedly higher, and its fixed charges are very much greater than those of the steam turbine. It is, therefore, very largely a matter of local conditions. If coal be high, intelligent labor plentiful, and capital not too dear, the gas engine is to be preferred. When these conditions are reversed, undoubtedly the steam turbine is the best. The intermediate conditions must be decided on their merits after careful examination of all the factors. The steam turbine has one great advantage in that it may be used as a low-pressure machine exclusively, and in two of the most modern plants which combine both blast furnaces and steel works the blowing engines are steam-driven and exhaust their steam at about atmospheric pressure into turbines which drive the electric generators. The turbine is by far the most economical motor in existence for low pressures, while it is inferior to the piston engine at higher pressures. This arrangement places each type of machine under the conditions for which it is best adapted, and makes a type of plant which has everything to commend it when the electrical requirements are sufficient to use up the steam from the blowing engines. In smaller sizes the electrical plant may be either steam-engine-driven or turbine-driven, the steam engine probably being preferable in small sizes and the turbine having an increasing advantage as the size of the plant increases. —*Met. and Chem. Eng'ing*, June, 1915.

Comparative Furnace Efficiencies.—R. J. WEITLANER. —An article giving simple formulas, tables and diagrams for figuring the comparative efficiencies of furnaces, when operated with different kinds of fuel or electric energy.—*Met. and Chem. Eng'ing*, June, 1915.

Fuel Supply Contracts.—JOHN B. C. KERSHAW.—An article on fuel supply contracts and the progress of more scientific methods of purchase and control in America and in different European countries.—*Met. and Chem. Eng'ing*, June, 1915.

Condensing Plant.—G. KLINGENBERG.—A description of a simple method, illustrated by a numerical example, for quickly determining the steam consumption of condensing plant.—*Elek. Zeit.*, April 29, 1915.

British Gas-Power Plant.—An illustrated description of the electric station which supplies energy throughout the urban district of Wood Green. Use is made of the direct-current three-wire system operated at a pressure of 240 volts for lighting and heating and 480 volts for motor service. Town gas supplied from the Tottenham works of the company furnishes the fuel for the generating plant. Two sets of generating plants have been erected, one of 100-kw rating and the other of 200-kw rating, and accommodation has been provided in the engine house for two additional sets of larger rating. The battery has a rating of 300 kw-hr. at a three-hour rate, or 200 kw-hr. for one hour.—London *Electrician*, May 21, 1915.

Transmission.—GEORGE R. DEAN.—The conclusion of his highly mathematical paper on the differential equations of long-distance transmission. A numerical illustration is given in the conclusion.—London *Electrician*, June 11, 1915.

Installations, Systems and Appliances

Working Cost of Central Stations; Municipal Versus Private Ownership.—C. ASHMORE BAKER.—An article entitled "Load-Factor, Output and Cost." The author first discusses the influence of the size of a central station (maximum load in kilowatts) on its working cost, and then takes up the discussion of the influence of the load-factor. The article is illustrated by numerous statistical diagrams. In the concluding part of the article the author takes up the problem of municipal versus private ownership of central stations in Great Britain, and concludes that "neither economy of first cost nor economy of administration or working is to be gained by private ownership." In Fig. 1 curve *A* shows the relation between price charged and load-factor for a British station of average size; this curve descends as the load-factor increases. Curve *C* is the total annual cost per kilowatt; this is an ascending curve, and the vertical distance between *B* and *C* represents net profit as far as the point at which they cross. The distance separating them beyond this point would be net loss. The author points out the following difference in policy as between company and municipality which these curves suggest. The object of a company is to keep net profits as high as possible, hence it has no interest in aiming at high load-factors unless it can obtain exceptionally

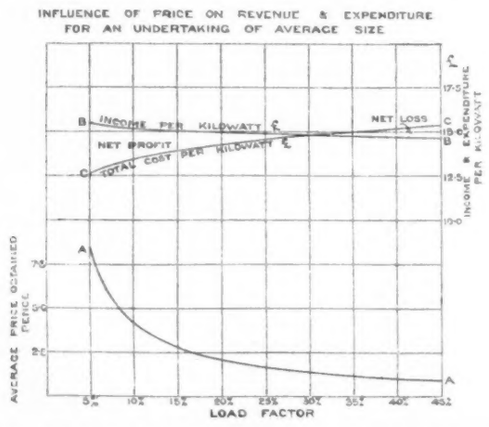

INFLUENCE OF PRICE ON REVENUE & EXPENDITURE
FOR AN UNDERTAKING OF AVERAGE SIZE
B INCOME PER KILOWATT £
NET PROFIT
NET LOSS
C TOTAL COST PER KILOWATT £
A
AVERAGE PRICE OBTAINED PENCE
INCOME & EXPENDITURE PER KILOWATT
LOAD FACTOR

FIG. 1—RATIO BETWEEN LOAD-FACTOR AND PRICE

high relative prices. The trend of its policy is to keep prices up, as, in fact, the companies as a rule have done. The object of an enlightened municipality, on the other hand, is to sell as many units as possible at the lowest price compatible with financial stability. The municipal engineer, therefore, is continually working toward the crossing point of the curves and endeavoring to push that crossing point as far as possible to the right by lowering his working expenses and increasing his load. The consumers respond by buying 40 per cent or 50 per cent more units per head of population where local authorities own the supply than they do in areas served by companies. Fig. 2 gives the relation between average price charged and the growth of sales in units

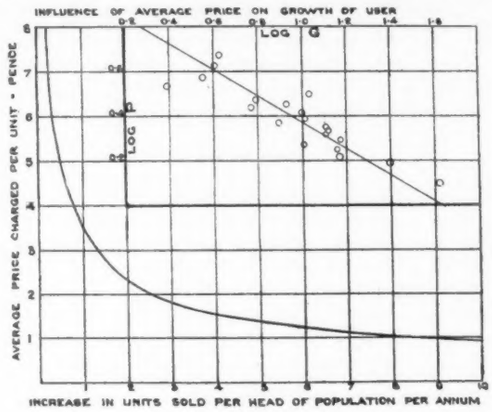

INFLUENCE OF AVERAGE PRICE ON GROWTH OF USER
LOG G
LOG P
AVERAGE PRICE CHARGED PER UNIT - PENCE
INCREASE IN UNITS SOLD PER HEAD OF POPULATION PER ANNUM

FIG. 2—RATIO BETWEEN GROWTH OF SALES AND PRICE

per head of population per year. It is taken over a period of five years, and inasmuch as the equation to this curve is practically the same for both companies and municipalities, it may be taken as being independent of ownership. "When we consider that the average cost [in Great Britain] of a municipally supplied kilowatt-hour for the year 1911-12 was 3.24 cents, as compared with 5.74 cents charged by the companies, the sociological value of public ownership becomes apparent. Thus it is difficult to discover (outside the pockets of shareholders and directors) any justification for the general principle of the supply of electricity by private enterprise."—London *Elec. Review*, May 28, June 4 and 11, 1915.

Electrophysics and Magnetism

Law of Magnetic Induction.—A. BLONDEL.—A paper presented before the French Academy of Sciences. Considerable discussion has arisen at different times as to the most general method of stating the laws of induction. The question is whether it should be considered that an electromotive force is produced by any variation in the magnetic flux which is included within the circuit of a conductor, or whether it is produced by the act of the conductor in cutting through a portion of this flux. The author has made use of a new experimental arrangement. This makes it possible to vary the total magnetic flux passing through a coil, and this is done by continuously varying the number of turns on the coil by a method which allows it to be unwound as desired. Assuming a constant flux through a number of convolutions, then the electromotive force should vary according to the rate of variation of the number of convolutions, if such variation can be brought about. The author attempted to create this variation by unwinding a coil placed in the field of an electromagnet so that the flux passed down the axis of the coil. It was found that if any electromotive force was observed it was due to the way in which the end connection was made, and the conclusion is reached that there can be an induced electromotive force in a circuit with a constant electromagnetic field only if the deformation of the circuit causes the lines of force to be cut by a moving portion of this circuit.—London *Electrician*, June 11, 1915.

Electric Conduction in Metals.—J. J. THOMSON.—A lecture before the British Institute of Metals. The accumulating difficulties of the electronic theory of metallic

conduction have led the author to discard all the electronic conduction theory except the single point that the current is carried by electrons. He now postulates, first, that a conductor is capable of polarization just like a non-conductor; that is to say, when an electric field is applied to it the molecules arrange themselves with positive ends pointing one way and negative the other—much as in the old Grotthus chain hypothesis of electrolysis. Second, he postulates that electrons can pass easily from one molecule to another when the negative end of the one is close to the positive end of the other, but not otherwise. The current through the metal is constituted of electrons skipping from molecule to molecule along chains of molecules. He shows by means of such premises that the startling discovery by Kamerlingh Onnes of the almost infinite conductivity of lead and mercury at the temperature of liquid helium can be explained.—London *Electrician*, May 28, 1915.

Thomson Effect.—A. G. WORTHING.—A description of a method of studying quantitatively the Thomson effects in tungsten, tantalum and carbon filaments mounted in evacuated chambers, with the aid of an optical pyrometer. The Thomson emf coefficients were determined for tungsten, tantalum and carbon for temperatures ranging from 1500 deg. K. to 2200 deg. K. (centigrade degrees from absolute zero).—*Phys. Review*, June, 1915.

Radium Emanation in Manila.—J. R. WRIGHT AND O. F. SMITH.—An account of an extended set of observations of the variation with meteorological conditions of the amount of radium emanation in the atmosphere, in the soil gas, and in the air exhaled from the surface of the ground, at Manila.—*Phys. Review*, June, 1915.

Roentgen Rays.—G. C. DREW.—An account of an experimental investigation of the ionizing potential of the Roentgen-ray tube.—*Journal Franklin Institute*, June, 1915.

Electrochemistry and Batteries

Electric Steel in Germany and Austria.—The total production of electric steel in Germany in 1914 was 89,336 tons, while that of crucible steel was 95,096 tons. The production of electric steel in Austria-Hungary in 1914 was 19,844 tons, that of crucible steel 17,557 tons. Of the total electric steel made in Germany 38.5 per cent was produced in induction furnaces. Of the total electric steel made in Austria-Hungary 45.5 per cent was produced in induction furnaces.—*Met. and Chem. Eng'ing*, June, 1915.

Chemical Industries of Germany.—PERCY F. FRANKLAND.—An article on the different chemical industries which have been established in Germany, giving historical and statistical notes, together with some additional notes on the prospects of the proposed British coal-tar industry.—*Met. and Chem. Eng'ing*, June, 1915.

Units, Measurements and Instruments

Vacuum Meter.—A note on the Heraeus electric vacuum meter, which permits the measurement of gas pressures down to 10^{-5} mm. of mercury. If a thermo-element arranged in a vacuum is provided with a constant supply of heat, the heating of the hot junctions is greater the less energy is withdrawn from the element by conduction in the gas, that is, the better the vacuum. In the Heraeus instrument twenty thermo-elements, consisting of narrow bands of two nickel alloys (electromotive force = 0.06 microvolt per degree) coupled up in series, are cemented between two square glass plates, which are 12 mm. thick and have each a central transverse hole 50 mm. in diameter, thus forming a cylindrical chamber along a diameter of which are arranged the junctions to be heated. Ten of the elements enter this chamber from each side, so that the hot junctions lie in two rows in juxtaposition. The ends of the chamber are closed by thin glass plates, and communication between the chamber and the space the vacuum in which is to be measured is made through a glass tube mounted in a radial hole. The constant supply of heat is afforded by means of a 10-cp., 10-volt incandescent lamp arranged with the filament opposite one end of the cylindrical chamber. A heavy nickeled metal casing is provided around the glass cell, which insures a constant temperature for the cold junctions of the thermo-elements. The electromotive force developed is measured by a voltmeter of the d'Arsonval type having a range of 18 microvolts, each division being equivalent to 10^{-4} volts. By means of a switch this instrument can be used for controlling the constancy of the current in the lamp used for supplying heat.—From *Zeit. f. Elektrochemie*, Vol. 20, page 539; abstracted in London *Electrician*, June 11, 1915.

Telegraphy, Telephony and Signals

Electric Bells.—C. TURNBULL.—The author criticises the usual design of electric bells and emphasizes that a properly designed electric bell should have a hammer

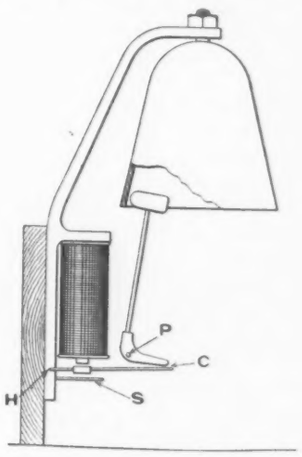


FIG. 3—DESIGN FOR ELECTRIC BELL

arranged to swing through an appreciable arc, while the contact should be made when the hammer is right back and broken only when the armature has come against the pole-pieces. The author's design is shown in Fig. 3. The armature is hinged at *H*, while the hammer is pivoted at *P*, the electric contact being at *C*. The armature rests against the stop *S* at the beginning of the stroke, while the hammer falls far enough backward to make the contact *C*. Current flows through *C* when the circuit is completed, thereby exciting the magnets, which draw up the armature with a jerk, so that the hammer is thrown against the gong and the contact *C* is also broken. The armature then falls back and remakes the circuit when the cycle is repeated. The stop *S* is made springy, which materially increases the force of the blows. "Owing to the fact that the contact is made when the armature is right back and not broken until it is against the poles, this form of electric bell is very efficient, while the slow and rhythmic stroke permits the use of musical gongs which ring out with pleasant tones." Laminated magnets give an appreciably sharper hammer blow, and should be used for large bells. The contacts may be made of nickel or similar metal, and are self-cleaning if the metal is thin enough to insure that the pressure is concentrated on a small area where they meet.—London *Electrician*, May 21, 1915.

Book Reviews

DIE ELEKTRISCHE KRAFTÜBERTRAGUNG. By Paul Köhn. Vol. 424 of Teubner's Nature Series. Leipzig and Berlin: B. G. Teubner. 121 pages, 137 illus. Price, 1.25 marks.

A little elementary textbook on the principles and practice of energy transmission and distribution by direct-current and alternating-current systems, intended for the use of central-station workers. The book is divided into nine sections on the following topics: Introduction, fundamental principles, generators and motors, transformers and converters, storage batteries, distribution, transmission from motor to machine, prime movers, applications of electric motors. It is abundantly illustrated and the treatment is simple. Only elementary algebra is employed. One of the best sections is that dealing with energy distribution.

ANLAGE UND BETRIEB KLEINERER ELEKTRIZITÄTSWERKE, INSBESONDERE MIT AUSNUTZUNG VORHÄNDENER WASSERKRAFT. By S. Herzog. Vienna, Austria: Jos. Eberle & Company. 168 pages. Price, 6 crowns.

This is an interesting and useful elementary book on the economical principles underlying the successful operation of small electric central stations, and especially hydroelectric stations. It has been written by a well-known electrical engineer of long experience. The book is divided into sections, not actually separated into chapters but dealing respectively with the following matters: General considerations, principal units, water-power plant, electric plant, preliminary work for the erection of a hydroelectric plant, technical operation of a hydroelectric plant, administrative operation of a hydroelectric plant. The volume is interleaved with numerous accounting forms illustrating the business side of operating an electric central station. The work is intended to serve as a business man's guide to the economics of an electrotechnical undertaking, with special reference to middle-European conditions.

DEUTSCHER KALENDER FÜR ELEKTROTECHNIKER, 1915. By G. Dettmar. Munich and Berlin: R. Oldenbourg. Two vols., illus. Vol. I, cloth, 656 pages. Vol. II, paper, 355 pages. Price, 4 marks.

This is the thirty-second annual appearance of a very welcome electrical engineers' pocket-book. It was originally produced in a single volume, but of late years it has been divided so as to occupy two pockets, although the second volume is designed more for shelf reference than for carrying about. The first volume is divided into fourteen sections relating to the following topics: Tables, units, magnetism, electricity, measurements, electric machinery, transformers, batteries, apparatus, central stations, lighting, energy distribution, miscellaneous, rules and standards. The second volume contains sixteen sections as follows: Electric railways, contactless electric railways, electric vehicles and launches, telephony, telegraphy, fire telegraphs, annunciators, electric signals for railways, electric mine firing, electric clocks, protection of buildings against lightning, electrochemistry, electroplating, physics, mathematics, tables of mechanical dimensions. The material for the preparation of the book has been divided among a number of specialists. The general result is excellent. The book is a fine collection of reference material, in a convenient form for immediate application to engineering purposes. Incidentally, as is of course sure to appear in a large mass of material, there are certain passages which seem to be a little out of date, and which in the next annual volume might well be amended. For instance, in the directions for administering artificial respiration to a person rendered unconscious by electric shock the old Sylvester recumbent position and technique are detailed, instead of the more modern and simpler Schaefer prone position and technique.

POLYPHASE CURRENTS. By Alfred Still. New York: The Macmillan Company. 300 pages, 84 illus. Price, $1.50.

This little textbook, which is now passing through its second edition, can be safely recommended to all students. Reference to the inaccurate knowledge of the author in connection with the history of the theory of the polyphase induction motor should be made, but this does not seriously detract from the usefulness of the volume.

PRINCIPLES AND PRACTICE OF ELECTRICAL ENGINEERING. By Alexander Gray. New York: McGraw-Hill Book Company, Inc. 392 pages, 449 illus. Price, $3.

This thoughtful author has produced a most interesting volume. While claiming in no way originality of treatment or new contributions, it is a work of considerable merit, which, in the hands of students as well as engineers not familiar with electrical-engineering problems, must be of great usefulness. The books of Prof. Karapetoff are really the only works of a similar nature with which Prof. Gray's book could be compared.

SCHÖPFUNGEN DER INGENIEURTECHNIK DER NEUZEIT. By Max Geitel. Vol. 28 of the Teubner Nature Series. Leipsic and Berlin: B. G. Teubner. 106 pages, 32 illus. Price, 1.25 marks.

A handy little volume of recent engineering accomplishments in various fields and countries. The book is divided into nine chapters, relating respectively to the following topics: Steel structures, tunnels, canals, hydraulic central stations, electric railways, elevated railways and subways, radiotelegraphy, large steamers, airships and aeroplanes. The descriptions are interesting and are intended for the general reader rather than the specialist. There are, among others, pictures of the Forth Bridge, the Woolworth Building, the Panama Canal, the Jungfrau electric railway, the steamship *Vaterland* and a Zeppelin airship. The author has, therefore, broad-mindedly included engineering achievements in a number of different countries. The last chapter on airships and flying machines is perhaps the most fully developed.

DRAKE'S TELEPHONE HANDBOOK. By David Penn Moreton. Chicago: Frederick J. Drake & Company. 286 pages, 159 illus. Price, $1.

This handbook, by an associate professor of electrical engineering at Armour Institute, is obviously "written down" to meet the needs of the so-called practical man in telephony. The first five chapters deal with the elements of electricity and the measurement of resistance and capacity. Chapter VI, on "Sound," ties together rather too closely the physical phenomena of audible molecular vibrations and visible electromagnetic waves, but nevertheless should be of assistance to the lay reader in forming a conception of the mechanical basis of sound. The two succeeding chapters are on magneto-telephone instruments and systems and common-battery systems. Chapter IX goes into some detail on the practical construction of telephone lines and contains statements of erection cost for various conditions. The book closes with a tabulation of common telephone troubles and their remedies.

ENGINEERING ECONOMICS. First Principles. By John Charles Lounsbury Fish. New York: McGraw-Hill Book Company, Inc. 218 pages. Price, $2.

This is a valuable textbook on engineering economics, based on simple algebra, common sense and ordinary arithmetic. It commends itself to the reader by its clearness of exposition and simplicity of style. It is one of the few books on the quantitative theory of economic structural values that are sufficiently interesting in their mode of presentation to make them readable for pleasure as well as for profit. When one perceives the logical arithmetic of such quantities as "scrap value," "salvage value" and "amortization," the careless and indiscriminate use of such terms becomes not merely a meaningless vapidity but also a positive intellectual crime. The proper use of such terms should be insisted on by all who strive for simplicity, clearness and communicability of economic ideas. The book is divided into five parts, relating respectively to introductory material, elements of the problem of economic selection, solution of the problem of economic selection, bibliography of depreciation and tables. The author is to be congratulated on having produced a thoroughly practical, scholarly, sound engineering textbook on the arithmetic of economic principies.

WIRELESS TELEGRAPHY. By A. B. Rolfe-Martin, B.Sc. London: Adam and Charles Black. New York: The Macmillan Company. 256 pages, 143 illus. Price, $1.25.

This handbook on the fundamentals and practice of radiotelegraphy is written from the British viewpoint. It is exceptional in that, while it gives the conclusions of many of the mathematical demonstrations of earlier and more nearly complete theoretical works, it does not neglect the practical application of these results. After taking up, in the first three chapters, general considerations on the historical growth of information as to electromagnetic waves and resonance phenomena, the author proceeds to a practical discussion of condensers, inductors, detectors, spark-gaps and sending and receiving circuits generally. The chapter on aerials and earths is given over mainly to constructional details, while that on directive transmission covers the general arrangements of the methods advocated by Bellini and Tosi and the Marconi and Telefunken companies. The singing arc of Poulsen, the Goldschmidt alternator and Marconi's disk method of generating continuous waves are described, but no advantages of the sustained-wave system other than "a higher degree of selectivity" are given, beats receivers not having been mentioned. Measurements of wave-length and decrement are gone into, and the book closes with two long chapters on Marconi and Telefunken apparatus as known in England. The general treatment of the subject is good, and the work should prove of interest to engineering students of radiotelegraphy.

Books Received

Practical Applied Mathematics. By Joseph W. L. Hale. New York: McGraw-Hill Book Company, Inc. 206 pages, 184 illus. Price, $1.

Elementary Mechanics for the Practical Engineer. By John Paul Kottcamp. New York: McGraw-Hill Book Company, Inc. 182 pages, 85 illus. Price, $1.50.

Calcul des Lignes Aériennes à Point de Vue Mécanique par des Abaques. By André Blondel. Paris, France: La Lumière Electrique. 64 pages, 33 illus. Price, 5 francs.

RECENT TELEPHONE PATENTS

Combined Receiver and Transmitter

Messrs. E. S. Stewart and C. D. Stewart of Ottawa, Ill., are the joint inventors of a combined receiver and transmitter which can be used for linemen's test sets and similar purposes. The instrument, which is described in patent No. 1,138,698, is shaped like an ordinary watchcase receiver. The transmitter button is mounted upon the back of the case, and the movable electrode protrudes through a perforation in the rear wall of the casing. The air space within the receiver casing being thus closed, the receiver diaphragm can actuate the movable electrode by changing the air pressure.

Radiotelephony

When a telephone is used to receive wireless signals the greatest audibility is obtained if the fundamental period of vibration of the receiver corresponds with the frequency of the signal currents. A patent (No. 1,138,147), covering a method of adjusting or tuning a receiver to give this condition, has been granted to Mr. H. J. Power of Everett, Mass. To obtain the desired relation between the natural frequency of the diaphragm and the frequency of the signal waves, the magnetization of the polarizing magnet is varied. This is accomplished by a magnetizing coil wound around the poles or yoke and subjected to an adjustable current. To keep the diaphragm under a fairly uniform tension means are provided by which the length of the air-gap may be increased as the magnetization is increased.

Trunking System

A trunking system for use with semi-automatic telephone systems has been patented by Mr. F. R. McBerty of New Rochelle, N. Y. The circuits are arranged so that the trunk, while providing the necessary disconnect signals and restoring devices, is free from all grounds or energy flow during conversation. The possibility of the contacts acting as microphonic transmitters is thus eliminated. This patent (No. 1,138,879) has been assigned to the Western Electric Company.

Terminal Board

To facilitate testing and isolating trouble on so-called intercommunicating systems, Mr. H. T. Slee of Warwick, R. I., has devised and patented (No. 1,138,255) a terminal board on which all wires at each station are attached. Knife switches are included in each circuit. A voltmeter and ammeter are provided for testing purposes, and are so controlled by knife switches as to be readily inserted where required.

Miscellaneous Patents

Sometimes it becomes advisable to lock a telephone so that it cannot be used by unauthorized persons. A device for this purpose has been patented (No. 1,138,389) by Mr. Theodore Luby of Philadelphia. It consists of a plate for sealing the transmitter mouthpiece. The plate is held against the transmitter by locking it to a clamp which surrounds the stem of the transmitter.

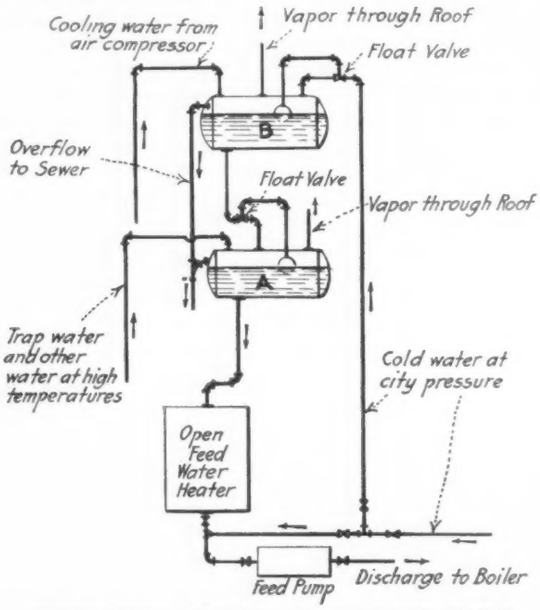
Patent No. 1,138,734, which was granted to Mr. E. J. Cressey of Wichita, Kan., describes a phonographic responding device which can be connected with a telephone when the subscriber is absent. The phonograph is designed to repeat numerals, the significance of which is given in a code used with the device. When a person calls a subscriber whose telephone is equipped with one of these devices it repeats the numerals to which it has been set. By consulting a code the calling party is advised of any message left by the absentee. For instance, number twenty in the code may mean "Gone for the day."

POWER AND OPERATING SECTION

A Double-Tank Method of Storing Hot Water

When it is desirable to save the cooling water from a compressor, or the water from any other such source, together with the heat contained therein, the arrangement shown in the accompanying illustration has proved satisfactory.

In the operation of this installation the condensation from the high-pressure and low-pressure drips, returns



CONNECTIONS OF TANKS TO SAVE HOT WATER

from heating systems and various other sources returning water at high temperatures to the feed-water heater is collected by traps and discharged into tank *A*. Water at colder temperatures, such as the compressor cooling water, is returned separately from the former and discharged under its own pressure into tank *B*.

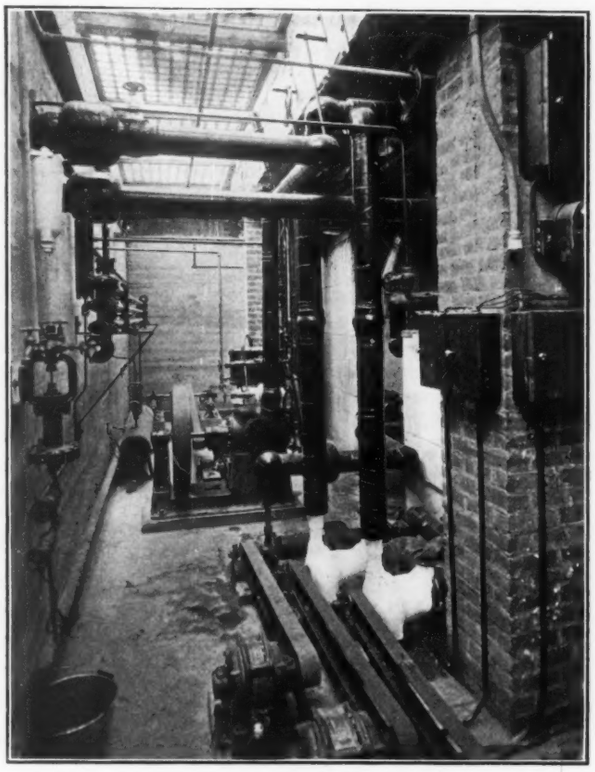
The arrangement is such that only the hotter water is admitted to the boiler, thereby effecting a saving in heat units and avoiding unequal strains in the boiler due to expansion and contraction from varying water temperatures. The feed pumps, too, may be kept in better condition. Any excess of water will overflow from tank *B*, which contains the colder water. The overflow in the single-tank method will cause a loss of the hot water which is mixed with the cold, and some of the water wasted in this manner may be required a few moments later because of fluctuating demands on the boiler.

Unusual Location of Motor-Driven Refrigerating Plant Proves Satisfactory

In the soda, confectionery and news shop of the Jones-Mannix Company in the new Park Building at Worcester, Mass., a motor-driven refrigerating plant situated immediately under the sidewalk monitors is supplied with electricity from the mains of the Worcester Electric Light Company. The location and natural lighting of this plant are unusual since ice-making and brine-circulating machinery is often relegated to the darkest and most inaccessible corner of a basement. As shown in the accompanying illustration, ample space is provided for the Jones-Mannix plant under the sidewalk, with the added advantage that inspection is facilitated and operating service improved through the lighting.

The shop uses six motors in its basement service, with about 13 hp of connected power load. An Italian marble soda fountain on the street floor is equipped with cold-storage chests, but no ice is used in packing the fountain since all the cooling is effected by brine circulated through coils by a pair of Goulds centrifugal pumps. These pumps have a capacity of 30 gal. per minute and are belt-driven by a 2-hp, 220-volt, three-phase induction motor. A third similar motor-driven pump is installed to circulate brine through a 40-gal.-per-hour Emery-Thompson ice-cream freezer chain-driven by a 2-hp motor running at 1200 r.p.m. The brine-pump motors run at 1800 r.p.m., and either one is capable of handling the normal service. These motors are bolted to two 2-in. by 2.75-in. by 17-in. timbers in each case, the latter being bolted into the concrete floor of the basement. The brine is cooled by a 2-ton ice machine belt-driven by a 5-hp, 220-volt motor running 1800 r.p.m. and mounted on two 3-in. by 6-in. by 32-in. timbers. The compressor is controlled by a Cutler-Hammer switch panel and was made by the Automatic Refrigerating Company, Hartford, Conn.

A storage tank holding twenty-one 3-gal. ice-cream containers is piped with brine coils, and the plant also



REFRIGERATING PLANT FOR A SODA SHOP INSTALLED UNDER SIDEWALK

contains a refrigerator equipped with brine coils fed by the pumps which supply the soda fountain. In this is mounted a carbonator driven by a 0.125-hp motor wound for 110 volts. The ice-cream tank is automatically maintained at 0 deg. Fahr. and the main refrigerator at 40 deg. Fahr.

Arrangements to Maintain Constant Oil Supply for Large Generating Units

An uninterrupted supply of oil to prime movers and generators is just as essential toward maintaining continuous service as perfect operation of an electrical system. Without lubricant the bearings of a machine will soon "run hot," and the resulting injury may tie up operation of a large portion of the system for a considerable period. Special attention was paid to these points in designing the gravity lubricating system in use at the hydroelectric station of the Pennsylvania Water Power Company, Holtwood, Pa., as shown in the accompanying diagram. The system consists of three 3000-gal. interconnected storage tanks feeding by gravity through as many pairs of 3-in. pipes into duplicate distributing mains. From these manifolds one 2-in. pipe runs to branch feeders at each machine, thus furnishing each unit with two channels of supply so that damage to one will not interrupt the service and at the same time provide a safeguard against lack of oil. Only two of the storage tanks, one oil filter and two 10-hp pumps are required for the station. However, an extra tank, an extra pump and three filters have been installed.

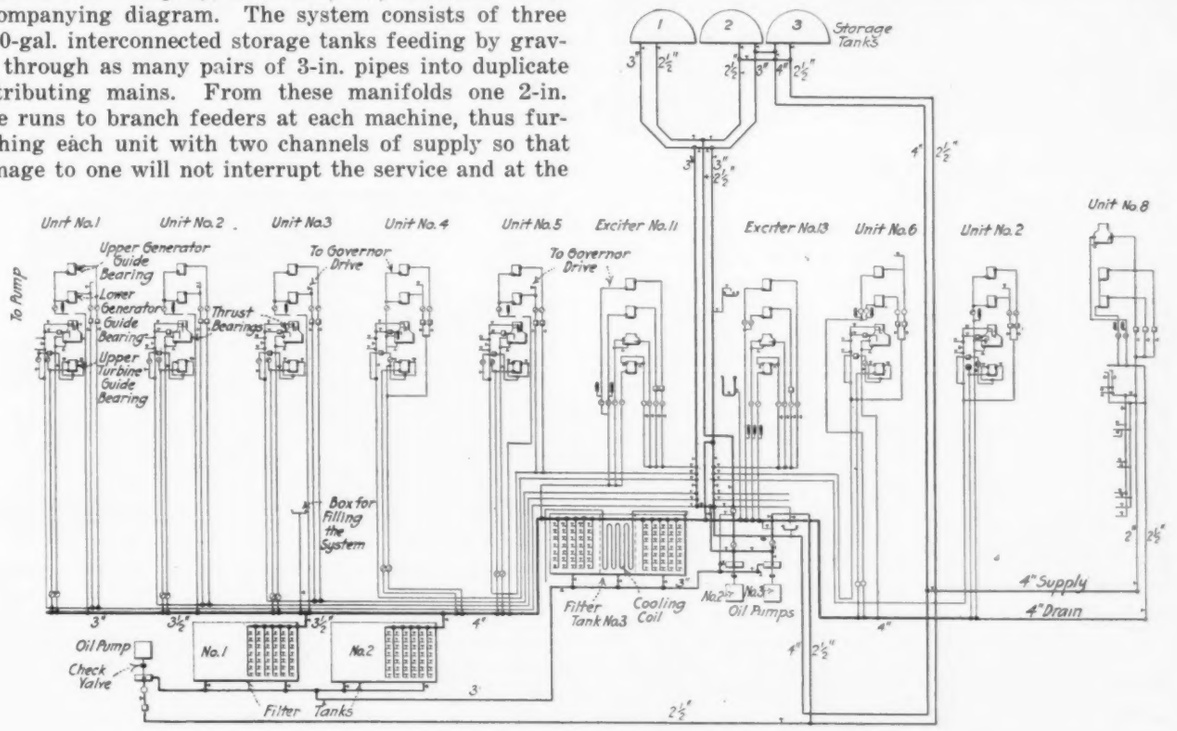


DIAGRAM OF OILING SYSTEM FOR LARGE UNITS IN A HYDROELECTRIC STATION

The oil is returned from the machine bearings to a common return header, which discharges into the three filter tanks. It is then lifted from the filter tanks to the storage tanks by 2½-in. single-stage 120-gal.-per-minute motor-driven pumps, when the oil flows around the circuit again. The storage supply requires that at least one pump shall be in operation continuously. Double-faced sight-flow indicators in the return circuits, recording meters and thermometers are used so that the circulation of the oil can be observed at any time and overheating of any bearing detected. Two of the oil-circulating pumps are driven by 10-hp direct-current motors and one by a 15-hp alternating-current motor. This selection of motors has been made to insure circulation of oil in case either the direct-current or alternating-current supply should fail.

The filter tanks are square, built of ¼-in. steel plates riveted together with the joints carefully calked. From the main discharge pipe leading into the filter tank ten pipes are tapped, and from each of these ten pipes seven smaller pipes are tapped, making a total of seventy discharge pipes, each of which is equipped with a valve, so that any one may be taken out of service. Each pipe discharges into a separate filter, which consists of a linen bag of 1-gal. capacity, woven especially for this service in order to filter at the rate desired. The filtered oil is discharged on a pan which delivers the oil over brass cooling coils, passing finally to the bottom of the tank, thus completing its cycle. All piping through which oil flows is of brass. Galvanized iron was considered, but on account of the danger of scale getting into the Kingsbury thrust bearings of the main units and causing damage, brass was finally selected. The cooling coils are also of brass on account of the corrosive effect on iron of the river water used for cooling.

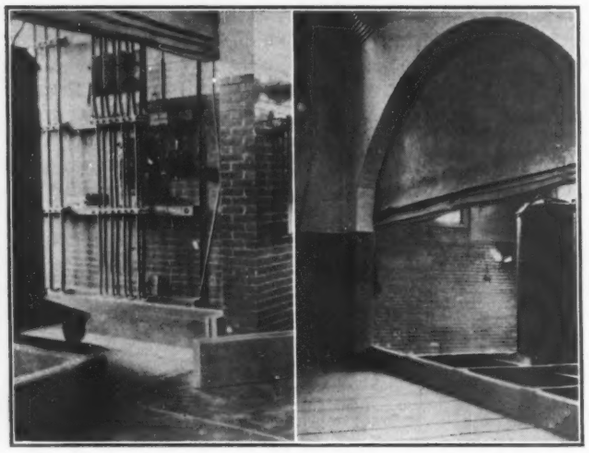
All power units are mounted on vertical shafts, and with the exception of a new turbine, marked No. 8, have four bearings which require a continuous oil supply, as follows:

	Gal.
Upper generator guide bearing	1.5
Lower generator guide bearing	1.5
Thrust bearing	15.0
Turbine guide bearing	2.0
Total	20.0

The new turbine has no oil-lubricated turbine guide bearing, and the two exciters require about one-half to one-third the above-mentioned supply. The quantities are those for winter operation and are increased about 20 per cent in summer. When all units are running it will be noted that 170 gal. of oil is required during the winter months and approximately 200 gal. during the summer months. The thrust bearings of all the units are submerged continuously in oil contained in a cast-iron oil housing of approximately 600-gal. oil capacity for the main units, and less for the two exciters. The rating of the eight generating units is 83,500 kw., and for the whole system 20,000 gal. of oil is needed.

Asbestos Fire Curtain for Transformer Room

Three 450-kw water-cooled transformers at the Saccarappa power station of the Presumpscott Electric Company, Westbrook, Maine, are mounted in a 20-ft. by 11.5-ft. compartment separated from the main operating room by a heavy asbestos curtain. In case of fire in the transformer bay the curtain can be dropped al-



AN ASBESTOS FIRE CURTAIN AND REMOVABLE SILLS OF A TRANSFORMER BAY

most instantly by a rope at one end of the room and all drafts cut off between the operating room and the transformers. The curtain is about 12 ft. high and is painted to match the interior finish of the operating room.

Another and convenient feature of the station design is an arrangement of mortised gates at the operating-room end of the oil recess surrounding each transformer. The sides of each compartment are of concrete, except at the end, where a 4-in. by 11-in. tin-lined dovetailed wooden sill is used. Each sill is 4 ft. 2 in. long and fits into a slot in the concrete end piece, 1.5 in. wide and 1 in. deep. The sills can be removed easily by hand, and the arrangement greatly facilitates rolling a transformer out of the transformer bay in the grooves provided for this purpose in the floor.

Horse and Scraper as a Help in Storing Coal

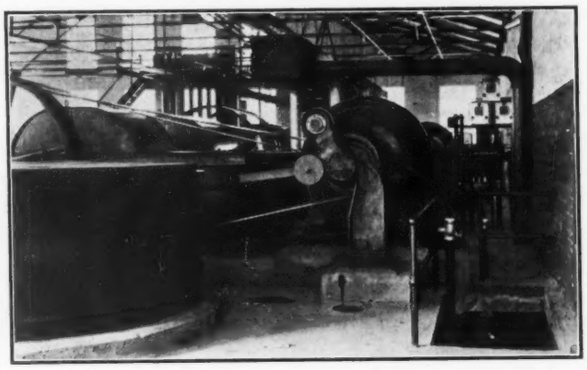
Central stations which are not provided with subaqueous coal bunkers frequently find themselves confronted with the necessity of storing quantities of coal in the open air. In such cases the coal is generally unloaded on the ground, and measures are then taken to prevent spontaneous ignition. A preventive of trouble from this cause is spreading the fuel so that the lower strata are under very little pressure. The sulphur content of the coal determines to a great extent how high it may safely be piled, but as a general rule unventilated coal piles should not be more than 10 ft. to 12 ft. in height.

SPREADING COAL WITH A HORSE AND SCRAPER

An economical method of moving coal away from car tracks is shown in the accompanying illustration. Two men with a horse and scraper can move more coal than a small army of shovelers can remove from the cars. Consequently with a medium-sized force at work it is not necessary to carry on the scraping continuously, but at intervals two of the shovelers can be taken from the cars to remove the heaps of coal which have been built beside the car tracks.

A Case Where a Light Belt Works Well on Short Pulley Centers

In the boxboard mill of the American Boxboard Company, recently completed at Grand Rapids, Mich., an idle-pulley belt tightener is effectively used to reduce the distance between centers of the driving and driven pulleys operating the beaters without increasing the width of pulleys and belt to dimensions called for by the short centers. The motor equipment for these 1000-lb. beaters



A 150-HP. MOTOR DRIVE WITH 15-FT. PULLEY CENTERS

consists of four Westinghouse 150-hp., 440-volt, three-phase, sixty-cycle, 435-r.p.m. slip-ring-type motors with double-extended shafts. To each end of the shafts of these machines an 18-in. by 16-in. pulley is attached for driving two beaters. The driven pulleys on these machines, measuring 72 in. by 16 in., are placed 15 ft. from the center of the motor pulleys to effect a considerable saving in floor space.

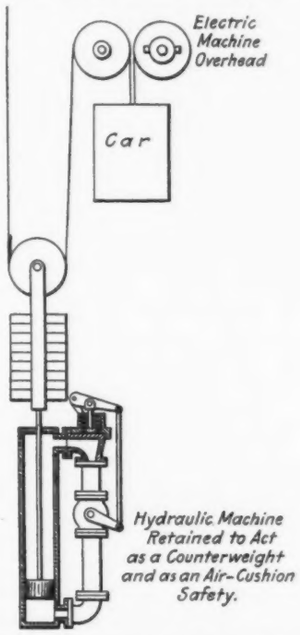
The engineers who designed the motor layout claim that even though the pulleys are operating with a four-to-one ratio on 15-ft. centers, the idle-pulley belt tightener, which is of the Lenix design, provides sufficient arc of contact for satisfactory operation. It is also said that in this case the arrangement permitted the use of a lighter belt.

Testing Rubber Gloves

To test rubber gloves, the Duquesne Light Company, Pittsburgh, Pa., fills them with water to within 1 in. of the top and suspends them in a tank of water until the level outside is the same as that inside, care being taken not to wet the upper part of the glove. One terminal of a 10,000-volt circuit is then immersed in the tank and the other connected with the water inside the gloves. The circuit is then energized and the voltage raised gradually to 10,000 volts. If a glove breaks down, a circuit-breaker opens the circuit.

Changing Old Hydraulic Elevators for Electric Operation

In a discussion on the subject of modern elevator problems at a recent section meeting of the American Society of Mechanical Engineers in New York City, Mr. Charles R. Pratt called attention to the fact that there are about 4000 old hydraulic elevators in New York City and ten times this number elsewhere, costing two



ARRANGEMENT FOR OPERATING OLD HYDRAULIC ELEVATORS ELECTRICALLY

to three times as much to operate as the modern electric installation. These are in all stages of repair, many of them being still good for a number of years' use. Mr. Pratt pointed out the possibility of converting these old elevator installations for electric operation.

In the accompanying illustration a suggested method is shown whereby an underbalanced car of a hydraulic elevator can be operated by an electric elevator motor. By the use of the underbalanced car, which is the controlling feature, and using the entire old hydraulic hoistway equipment undisturbed, even using the vertical cylinder for a continuous safety with a speed-regulating valve in the circulating pipe, for water, oil or air, about one-half the total cost of the change-over from hydraulic to electric operation is saved, with practically no interruption of the elevator service. Also, it is said that a net profit is shown to the owner after he charges off 10 per cent of the initial cost against the amount saved in power and operating expenses.

When the scheme shown here is used and the electric machine is installed below with a regulating valve placed in the circulating pipe, using either air, oil or water, two more grooves are added to the winding sheave. In the case of excess speed this balanced piston operates to choke off the circulating pipe and gives in effect very good safety.

Co-operation in the Engine Room and Boiler Room

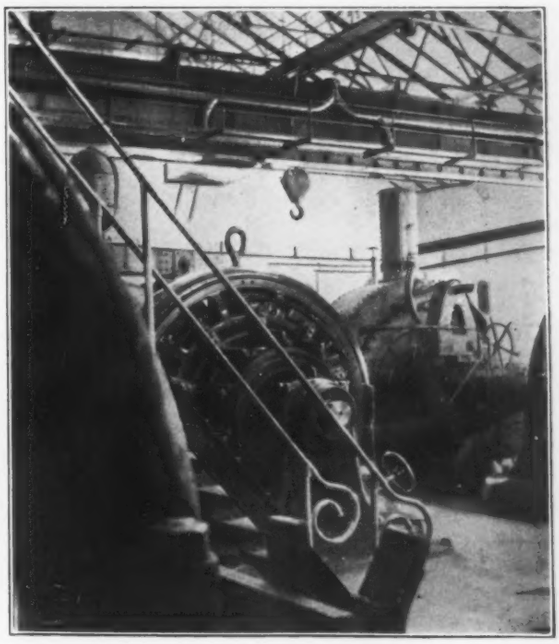
In choosing the personnel of the plant operating staff it is of importance to select men of sober and industrious habits, said Mr. Andrew Patterson, general superintendent of the Southwestern Gas & Electric Company of Texarkana, Ark., before the recent convention of Arkansas Public Utility Operators at Little Rock. "The men chosen should be suited or adapted by temperament to the class of work which they have to do," he advised. "Pay enough wages, consistently with the size of the property, so that operators will stay with you. It costs time and money to educate a man for the particular line of duty in which you place him, and frequent changing due to dissatisfaction is both annoying and expensive. The keynote of getting a successful operating staff for a power station lies in co-operation among its units, from the manager, superintendent or chief on down the line. Friction and dissension among employees can create more troubles—and these sometimes the hardest to locate—than anything else in the operation of the entire plant. Personal friction should not be tolerated one minute. The case should be investigated promptly, the party or parties receiving fair trial and consideration, but, this failing, dismissal must be resorted to."

Removing Dust Blown from Generators

In order to remove the dust blown from a generator and prevent it from settling on other apparatus on the operating floor, a vacuum system is used at station No. 2 of the Cliff Electrical Distributing Company, Niagara Falls, N. Y. As shown in the accompanying illustration, an exhaust pipe line extending the length of the station is attached to the roof trusses. This pipe line is equipped with a number of capped outlets so situated as to permit the making of a connection with branch exhaust piping attached to crane, as shown.

When it is desired to clean a machine by means of compressed air, the crane picks up a large canvas hood and places it over the generator to be cleaned. This hood is provided with an opening at the top, which is then attached to one of the outlets of the crane exhaust pipe. With the crane piping connected to the stationary piping on the roof trusses, a path to the outside of the station is provided and the dust due to cleaning a generator is entirely removed. An exhaust fan provides the vacuum necessary.

According to Mr. George R. Shepard, mechanical engineer of the company, this arrangement is giving satisfactory service.



EXHAUST PIPING ON ROOF TRUSSES AND CRANE TO REMOVE DUST FROM GENERATORS

COMMERCIAL SECTION

Carrying the Display Room to the Customer

A Traveling Demonstration Truck That Is Proving Its Worth to the Washington Water Power Company

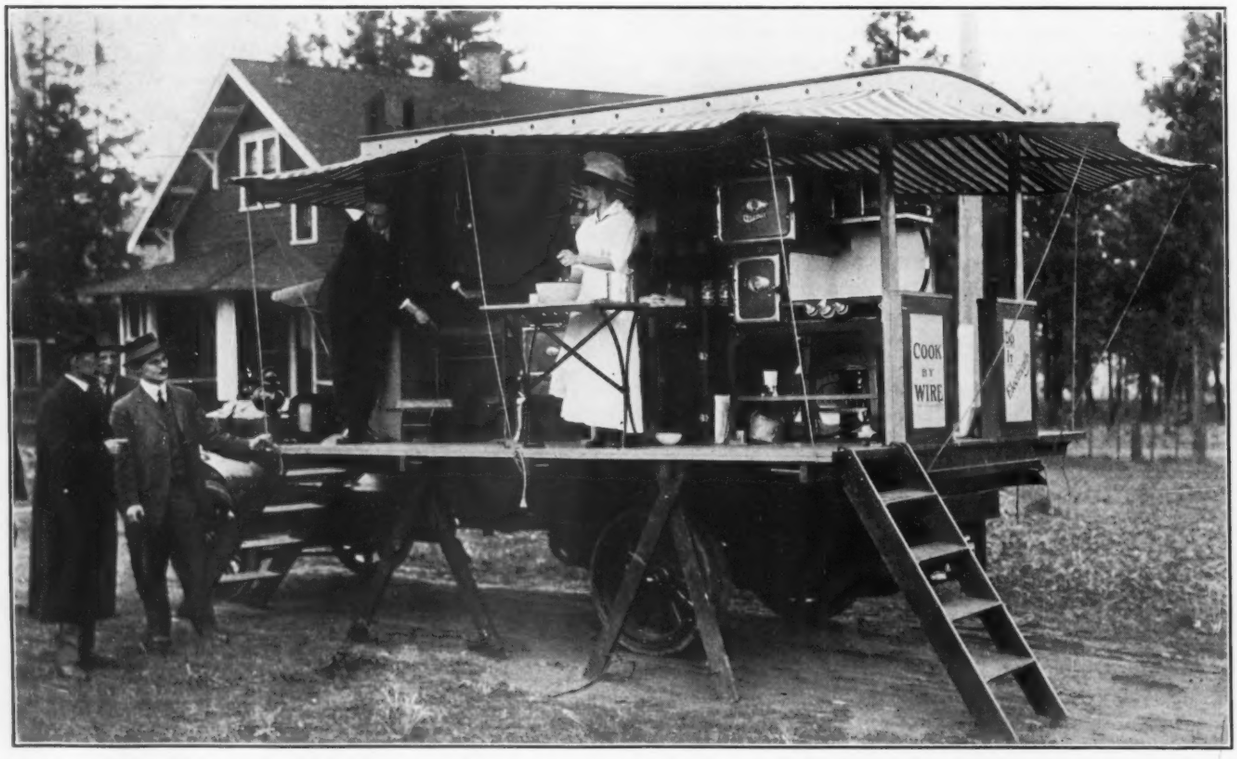
ANY demonstration of electric labor-saving appliances for the household or the farm appeals to every one of us. The subject is so basic and so vital and the ingenious modern applications of electric service have so strong a human-interest factor that there is never any trouble about holding the attention of an audience and creating the desire among its members that inevitably results in business. The great difficulty ever lies in gathering the audience.

The Need for Demonstrations

In the city and the large town the exhibition of electrical devices always draws a crowd; in fact, the demonstration of almost anything that touches on the issue of domestic management and points the way to new economies in the business of housekeeping is sure to be appreciated by the more progressive public. But with it all the proportion of the possible customers who are reached in this way is but small. Many men and women will not take the time and trouble to go to any demonstration of anything and the fact that to attend entails the coming of the people to the central-station salesroom acts as a barrier between this method of educational selling and a very large majority of the company's best "prospects." And so the question arises: If the people will not come, how can the demonstration be carried to them on an equally practical and effective scale?

Traveling railway-car demonstrations have been most successfully operated in several instances. Electric vehicles have been utilized in other cases with good results. And both have proved the idea to be practicable and profitable as a medium of advertising and as an opportunity for the sale of apparatus to consumers who are otherwise quite out of reach. The most recent illustration comes from the rural territory served by the Washington Water Power Company of Spokane, Wash. —a demonstration planned and operated by Mr. M. C. Osborn, commercial agent for that company.

The Washington Water Power Company serves a population of 35,000 on its rural lines alone, including some thirty-five small towns, and in most cases the lines between these towns operate at pressures of 6900 volts and in some cases at 2300 volts. This arrangement permits supplying farmers at a considerable distance from the main line, but the majority of these farmers have not been fully aware of the possibilities of the service



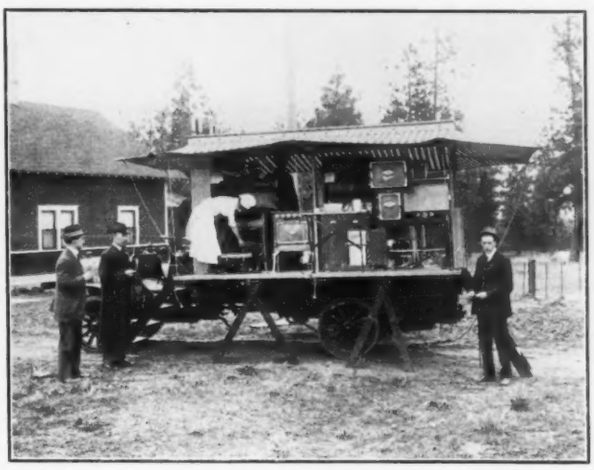
THE TRAVELING ELECTRIC SHOP OF THE WASHINGTON WATER POWER COMPANY FOR DEMONSTRATING APPLIANCES TO THE SUBURBAN POPULATION REACHED BY ITS LINES

WITH PLATFORMS FOLDED UP TO FORM ITS SIDES, AND AWNINGS DOWN, THE CAR IS READY FOR THE ROAD

they have available. It was believed, however, that if a demonstration of ranges, washing machines, pumps, separators and other farm and household appliances could be made to them they would be quick to grasp these opportunities. For the farmer and the small-town customer afford a logical market for all these labor-saving applications of the service, and to a greater degree than would an equal number of households in the city. Farm people are, of necessity, deprived of many of the comforts that the city family enjoys as a matter of course, and are therefore all the more eager for such added conveniences. But they are not likely to visit the central-station display room in the city whence the service comes, and they have little opportunity for actual contact with its modern wonders. The demonstration of appliances must be carried to their homes.

The Equipment of the Car

For this purpose a 2-ton Packard truck was fully equipped by the Spokane central station with every electrical convenience the farmer would be likely to require. Under the truck there are hung two transformers, one for 2300-volt, the other for 6900-volt lines, both transformers being of 5-kw. rating. To obviate the necessity for an oil switch, expulsion-type fuses are used for the primaries of both transformers. These can be seen in the pictures, at the front of the car. To make primary connections a pair of bamboo poles with clips has been arranged so that the primary wires do not have to be touched by the operator. A small distribution box is carried at the front end of the car with a double-throw service switch, so that the secondaries of either transformer can be connected to the load of the car. All circuits are installed with fuses to assist in locating the source of trouble. For decoration after dark, a row of sign lamps was run around the top, forming an outline. In addition, four 250-watt tungsten lamps are provided to furnish illumination of the interior. These, connected to the car by flexible cord, are mounted on poles set a few feet from the car, so that the lamps are well above the heads of the audience during evening demonstrations. The sides of the car are arranged to drop down, being hinged at the floor line and thus forming demonstration platforms. In a similar way the canvas side curtains were arranged to form awnings.



ELECTRIC RANGES LARGE AND SMALL ARE INCLUDED IN THE CULINARY EQUIPMENT

The Display Outfit

The display equipment of the car is divided into two parts, one given over to electric appliances pertaining to the kitchen while the other is primarily of interest to the farmer himself. The appliances are grouped on the right and left sides of the car respectively. On the kitchen side are a General Electric range, a Hughes range and a Copeman automatic range, and in the center of the range display is the smallest kitchen cabinet obtainable. In the top of this cabinet is placed a tank for hot water, heated by an electric circulating water heater. On the other side of the car are displayed a cream separator, a churn and a washing machine, all electrically driven. In these it is possible actually to separate the cream brought in by the farmers and then to turn the cream to butter. On the machinery side there is also a deep-well pump equipped to start and stop automatically. Other small appliances are also displayed on the platform of the machinery side, with a small rug for use in demonstrating a suction sweeper. In the rear, in the small-motor department, provision is made to display a sewing-machine motor and utility motor together with a bench drill of small size.

FARMERS MAY BRING IN THEIR OWN CREAM TO BE CHURNED TO BUTTER BY ELECTRIC POWER

Advertising Methods

To advertise this display as it goes about the country a personal letter, signed by Mr. M. C. Osborn, is sent to each farmer's wife, describing the demonstration scheduled for her neighborhood and stating as closely as possible the date on which the demonstration will be held. As a further aid to publicity, a series of films descriptive of the properties of the Washington Water Power Company are exhibited at the local motion-picture theaters where such theaters were available.

The crew of the traveling shop consists of a salesman in charge of the car, a woman demonstrator, and a combination lineman and driver who can also take care of any mechanical trouble among the exhibits. The car started out on April 26 of this year and will probably be on the road continuously until August, at which time the harvest season will not permit the farmers to give much attention to matters other than the handling of their crops. Orders taken by the traveling shop are mailed daily to the home office in Spokane, Wash. From here delivery is made by parcel post to the consumer.

Mr. Osborn reports that the plan is working well and that the car is creating interest wherever it goes. The fact that it becomes a neighborhood affair seems to appeal very strongly to the people both in the small towns and in the farming country, and the farmers and their wives and their daughters turn out to see the demonstration, with a serious regard for its utilitarian value and an intelligent appreciation of the personal opportunity it suggests and offers. The motor-truck demonstration is proving itself a vehicle for advertising and sales that can be profitably utilized by any central-station that serves outlying territory too remote to be within easy reach of the office display room.

A Bean-Guessing Contest That Won Much New Business

How many beans will an incandescent lamp globe hold? This question formed the basis of a guessing contest recently held by the New Midland Power & Traction Company, Cambridge, Ohio, to stimulate the sale of tungsten lamps, and particularly to obtain a census of wired and unwired houses and a list of "prospects" for appliances. The process was simple. A lamp full of beans was surrounded with suitable placards calling the reader's attention to the fact that there was a guessing contest going on inside. Everyone who entered the store, which by the way served also as a waiting-room for railway passengers, received a guessing

GOOD FOR ONE GUESS IN BEAN GUESSING CONTEST

NEW MIDLAND POWER & TRACTION COMPANY

My guess is.....beans.

My name is.....

Address .....

My **home** { is / is not } wired for electricity.

{ am / am not } a consumer.

If my guess wins I desire a

.....appliance

or $5.00 toward cost of wiring my home.

BALLOT USED IN CONTEST

blank, which, when properly filled out, contained, besides the person's name, address and guess, a statement as to whether or not his home was wired for service and what appliance he would desire if his guess won the prize. An extra guess was allowed with each tungsten lamp purchased during the contest. The prize announced was three five-lamp cartons of lamps up to the 40-watt size, or $5 toward the cost of wiring a house, or, if the winner preferred, he was to receive his choice of any five-dollar electrical appliance, or a five-dollar rebate on a more expensive appliance.

Mr. W. S. Hays, former superintendent of the company, gives the following directions for preparing the lamp. "Take a tungsten lamp," he says, "preferably a big one, and remove the base by knocking the tip from the bulb and heating the base slowly to soften the cement. Break out the glass supporting the stem and fill the bulb with kidney and lima beans, with which, if care be taken, a very pleasing effect may be produced, though care must be used in handling the globe because of its fragility. Fasten the base back on (shellac will hold it) and screw the bean lamp in a socket, suspending it from a drop cord in your display window or over your lamp counter. The mixture of different sizes of beans is important because it prevents the public from finding out by experiment how many beans the lamp actually contains."

Bean-guessing contests are always popular in that section of the country, and this one was no exception. In the two weeks that it lasted more than 1000 guesses were cast, though the population of the town is only 15,000. All the five-dollar appliances were placed in view near the ballot box, and demonstrators were ready to explain and to show any or all of them in operation. As a rule these demonstrators were kept busy, for when a person received a ballot and noticed that he must make a choice he generally sought a demonstration of every appliance on display preliminary to his guess. This had immediate effect, for a number of heating pads and irons were sold in this way before the customer cast his guess ballot.

The contest, by arousing a desire for such appliances, automatically stimulated the wiring of old houses, and, in fact, the person who won the contest did not live in a house already wired. The prize selected was a heating pad, chosen because one of the members of the family was ill, and the house was immediately wired in order to take advantage of it. But the further benefits were large, for, besides developing a large, authentic list of unwired houses, the owners of which had had their interest aroused by the contest and the demonstrations, an excellent appliance "prospect" list was formed. Each guesser, by signifying on his ballot the particular appliance he desired, furnished the sales staff with an excellent clew as to the best way to make the first sale. In most of these cases all that was needed was just a little judicious guiding by the salesman, for when the prospective customer had already decided that he wanted that appliance the rest was easy.

Regular Rates for Short-Time Service

During the construction of a large concrete bridge at Cedar Rapids, Ia., last year electrical energy was used almost exclusively for pumping water from pier foundations and for mixing concrete. The installation consisted of a 40-hp motor and a 20-hp motor connected to two centrifugal pumps, a 10-hp motor driving a concrete mixer, and a 10-hp motor belted to a set of saws used in making forms for the concrete.

Beginning its operation in May, 1914, this apparatus was used for five months, and in that time it consumed nearly 10,000 kw-hr. For this service the established motor-service rates, ranging on a sliding scale from 9 cents a kw-hr. to 3 cents a kw-hr., were charged. The rates netted the central-station company an average of about 4.5 cents a kw-hr., which from the electric company's standpoint was thought reasonable.

Mr. Edward Soukup, superintendent of the commercial department of the Iowa Railway & Light Company, which supplied this energy, said that the contractor had expressed his complete satisfaction with the terms of the contract and had recommended central-station motor service to other construction contractors. "The motor-driven saw," said the contractor, "is a great convenience. It saves many trips to the planing mill."

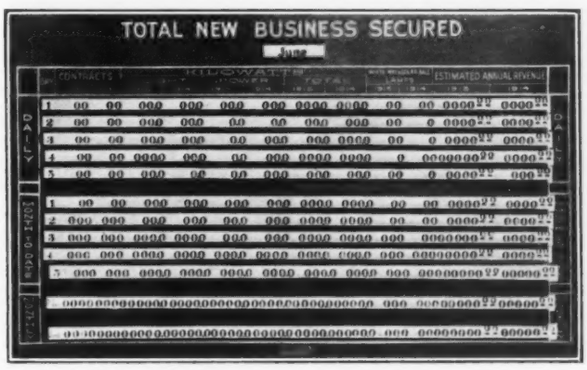
Eliminating the Painted Sign at Akron, Ohio

The Northern Ohio Traction & Light Company of Akron, Ohio, has recently conducted a successful campaign, which was inaugurated for the purpose of displacing small painted-board signs with modern electric signs. The campaign was opened by a circular letter sent to the owners of such signs asking them if they would pay a clerk for twelve hours' work if he worked only six hours. From this premise the letters led up to the fact that the old signboards over the merchants' doors were valuable only in the daylight and hence were doing only one-half duty. The first effect of this letter was to cause many merchants to install lamps on the boards already in place, but when they saw how unattractive their home-made signs were as compared with the manufactured signs which had been purchased by their neighbors, the makeshifts were in many instances taken down and properly constructed signs were installed to take their place.

Sales Records Conveniently Displayed

Believing that it is advantageous for a sales organization to be able to compare at an instant's notice its previous yearly records with those of the present year, the Union Electric Light & Power Company of St. Louis has instituted the use of sales-record bulletin boards. In the offices of Mr. A. C. Einstein, general manager, and Mr. F. D. Beardslee, sales manager, are bulletin boards which indicate day by day the total business secured by the entire sales department. Other boards in the industrial, commercial, residential and main office application divisions contain daily records of the business secured respectively by these branches of the department.

There are three main horizontal divisions to the board, one for the daily record, one for the month to date, and one for the total month. The first two horizontal divisions consist of five metallic slots, allowing five days' record to remain on the board. The third division is provided with two slots for the record of the previous as well as the current month's totals. The boards are divided into vertical columns, headed "number of contracts," "kilowatts light," "kilowatts power," "kilowatts total," "white way and solar-ball lamps," and "estimated annual revenue." Each column is subdivided to allow entry of this year's record and last year's record for comparison. The boards were made for the Union Electric Light & Power Company by the Brilliant Sign Company of St. Louis, Mo. The paper strips used for insertion in the slots are printed with a set of rubber stamps in the sales-department office and then distributed.



BULLETIN BOARD FOR SALES DEPARTMENT

These bulletin boards have been in use several months, and the ease with which they make it possible for the manager and salesmen to visualize the progress of sales work is proving the boards to be a great convenience. The fact that the records are thus displayed before the men each morning also serves as an inspiration for the salesmen to exceed last year's records.

Electric Detonator for Civic Celebration

The inauguration of a system of "white way" lighting at Lowell, Mass., was signalized by a flashlight-powder demonstration in front of a reviewing stand in one of the principal squares, which was occupied by members of the city government. As the Mayor threw a silver switch cutting the system into operation through a signaling circuit run to the generating plant, a tray of flashlight powder mounted about 20 ft. above the roadway, as shown herewith, was ignited by short-circuiting a 110-volt current through a small fuse buried in the powder. The holder was about 24 in. long and formed of two 4-in. angles, and the resulting "Hurrah, boys!" effect, though at some distance from the stand, captured the crowd.

ELECTRIC DETONATOR IN PLACE

Second-Hand Appliance Sales for Employees

The Commonwealth Edison Company has an old-appliance display room where are kept, among other things, appliances that have become slightly worn from demonstrations and also appliances that have been scratched, dented or otherwise marred but not actually injured. These appliances are on sale at reduced prices, and since they receive the same guarantee as spick-and-span, brand-new appliances they find a demand. Recently the company had on hand some of these "just-as-good-as-new" washing machines, which they offered to employees on the instalment plan at a saving of $35 per machine. A machine would be delivered to any address, but the purchase order had to be signed by an employee of the company. By thus working on the natural instinct of the race to snatch at real bargains, the company is able to place on its lines many high-priced devices which would otherwise not be in service.

"STANDARDIZED CO-OPERATION"

The Contractor Should Understand and Indorse the Central Station's Policies and Methods

In a recent address before a joint meeting of the New England Section of the N. E. L. A. and the Massachusetts Electrical Contractors' Association, Mr. L. D. Gibbs, president of the New England Section, emphasized a new point of view in regard to co-operation between the contractor and the central station.

The contractor is doing all he can to help the central station, he said, on account of the work which the latter has done for him in recent years. Every central-station employee who is succeeding in his work keeps keyed up to the highest point of sensitiveness in his relations with the public. He makes it a point everywhere to please the customer in every possible way for the sake of the good will that will be developed, for he realizes that "one pleased customer means ten." No matter how big the advertising department of a central station may be, no matter how generous the company is, this cannot offset a careless manner, a neglect and top-loftiness on the part of the men who meet the public. Just so the electrical contractor has a peculiarly intimate relationship with the people who as soon as they pass out of his hands will be the customers of the lighting company. The contractor and his employees working in any building come in contact with great numbers of workmen, with owners, and occasionally with the contractor erecting the structure. Here is the first place where the electrical contractor can co-operate with the central station. He should, first of all, understand its methods and be in entire sympathy with its policies. The contractor is a small dealer who does business ordinarily on a small scale and meets few people. His investments are comparatively small and his risks are not very serious. The central station has a large investment, is meeting people not only as individuals but in organizations and in city and town governments, and must adjust its policies not only to please the people but to give the best service and consequently obtain a satisfactory return on its investment. It stands to reason, therefore, that the central station should be the guide to determine the policies under which the business should be carried on. Instead of standing back and arguing and attempting to dictate to the central station, the contractors should fall in line and take the first step in standardized co-operation by working along lines approved by the central station.

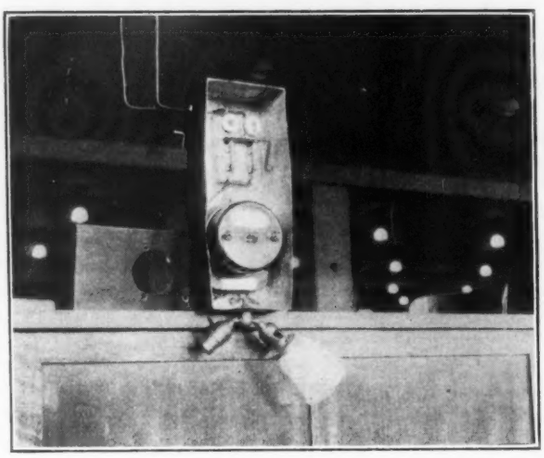
How the Contractor Can Help

The next important step is not only to agree to this policy and follow it but to talk about it. It cannot be said in the electric-light business that "every knock is a boost," because a central-station man and persons friendly to central-station interests cannot always be around to explain the various conditions in connection with the "knock" and thereby turn it into the "boost." Every electrical contractor has his own circle of hundreds of acquaintances with whom his word is taken as authority on electrical matters. In these circles every contractor should be active in the interest of electricity and of the central station's policies.

"The committees that have been appointed to work jointly for the advancement of standardized co-operation," said Mr. Gibbs, "might take one subject each month, every man agreeing to talk favorably upon it. Through the contractors' association and through the office of the New England Section of the N. E. L. A. printed matter could be sent out explaining the subject under consideration each month and pointing out ways of bringing it more definitely to the people's minds. This subject need not be a bargain sale in flatirons, percolators or lamps, but can simply be the consideration of some one policy that is common to all the companies and can therefore be talked over freely throughout the State. For example, there is the matter of requiring deposits from new customers, the question of taking applications by telephone, and of how the peaks of disconnections and new connections should be handled on moving days which happen about May 1. These peaks mean a tremendous unusual expenditure, and perhaps some way can be devised for spreading out the work. The discussion of such problems will certainly make better topics of conversation than the weather and our neighbors' affairs and will get the contractors and the central-station men together and closer to the people."

Service Box, Lamp, and Iron or Fan for $12

For several months the Kansas City (Mo.) Electric Light Company has been installing a two-outlet wall bracket, with a 60-watt lamp and a 6-lb. iron, all for $12, payable in installments of a dollar a month. The



SERVICE BOX INSTALLED IN TWELVE-DOLLAR WIRING OFFER AT KANSAS CITY

returns were large. Late in May, however, an electric fan was added to this offer—and the result was a dozen orders the first day, despite the fact that the preceding week had been cold and rainy. On June 1 the real business began when the company instituted a campaign, advertising the offer in newspapers and on billboards.

In designing the service box used at Kansas City the two things aimed at in offering such cheap installations were extension of service and the minimizing of the surreptitious wiring hazard. The result, therefore, is: a box attached to the conduit where it enters the wall, and in the box the meter, its face visible through a circular orifice; the fuses; the switch, operated by a handle protruding from the side of the box; while supported from and below the box is a bracket with two sockets, one for the lamp and the other for the attachment cord to which the electric iron or the fan can be connected. The lid is sealed on, and any tampering can be at once observed by the meter reader. The entire device is made in the company's shops. Its installation is simple and inexpensive, involving merely the running of wires, the drilling of the hole for the conduit, and the placing of the conduit and box on the wall. If later the customer desires to have his house wired, the box can be taken down and used by the company elsewhere. The finished boxes are of black metal covered with black enamel.

NEW APPARATUS AND APPLIANCES

Combined Snap Switch and Separable Attachment Plug

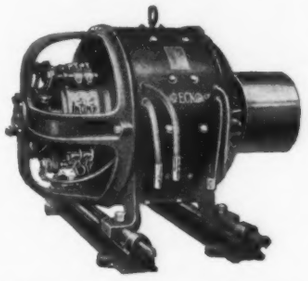
A device consisting of a combined snap switch and separable attachment plug, designed for increasing the flexibility of fan-motor control, has recently been placed on the market by the General Electric Company, Schenectady, N. Y. The separable cap consists of a single-pole snap switch with two finger contacts which fit into the body of the separable plug. The plug can be screwed into any available socket or receptacle, and from this point the fan circuit can be opened or closed. The switch cap may also be used without the attachment plug, as the finger contacts are designed to fit the various separable receptacles made by the above company.

COMBINED SNAP SWITCH AND ATTACHMENT PLUG

Direct-Current Motors

Motors rated at from 3 hp. to 40 hp., of the direct-current constant-speed and adjustable-speed types, have recently been developed by the Eck Dynamo & Motor Company, Belleville, N. J. Commutating poles and double-row self-aligning ball bearings are utilized with these machines, and ventilation is obtained by means of fans and ducts. Grease is employed for lubrication and large-sized grease chambers are provided. The manufacturer claims that the motors operate at high efficiencies which are uniform over a wide range of load.

The magnet frames are of cast steel of high magnetic permeability, it is declared. The pole pieces consist of steel laminations and are assembled so as to leave transverse channels or air ducts which permit cool air agitated by the fans to circulate not only around the outside of the field coils but also through the pole core itself, thus providing effective internal ventilation. The number of commutating poles employed is equal to the number of main poles. The armature is built of a series of sheet-steel laminations insulated from each other. The assembly of the laminations is made in such a manner that large spaces for the circulation of air are provided in a longitudinal direction at right angles to the shaft. A multivane fan is securely attached on the driving end of the armature core, and when the armature revolves it draws cool air from the outside and forces it through the entire machine.



DIRECT-CURRENT COMMUTATING-POLE MOTOR WITH BALL BEARINGS

Care has been taken in the design of the machines, the manufacturer points out, so that none of the parts are so shaped or assembled as to form air pockets. The use of ball bearings permits the employment of shafts of short lengths. The commutators are of hard-drawn copper-wire bars and are mica-insulated throughout. The slots of the armatures are not parallel with the shaft, and as a result it is claimed that the motor is absolutely free from magnetic hum.

Separable Attachment Plug

The attachment plug shown in the accompanying illustration has recently been developed by the Chelton Electric Company, 314 Armat Street, Philadelphia, Pa., for use with its composition receptacle. It is designed for 660-watt, 250-volt service, and is interchangeable with other types made by the above company. The plug has been approved by the Underwriters' Laboratories.

COMPOSITION ATTACHMENT PLUG

Portable Adjustable Lighting Fixture

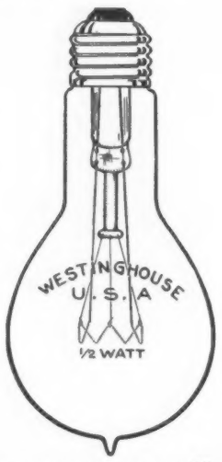
A small portable fixture for incandescent lamps which can be used as a stand, as shown herewith, or can be clamped or hung in various positions, has been placed on the market by the Rose-Strauss Company, 209 West Forty-eighth Street, New York. Ten feet of cord is provided with the fixture, and this cord when not in use is rolled up in the base. The cord can be pulled out to any length desired and is automatically rewound by means of a small push-button just below the outlet

ADJUSTABLE FIXTURE FOR INCANDESCENT LAMPS

through which the cord passes. The fixture is equipped with a clamp of piano spring wire which is covered with rubber. The base is highly polished so that it will not scratch smooth surfaces. The lamp can be turned in any direction desired. The manufacturer points out that the fixture will remain stationary while pulling the cord to the length wanted. The shade is equipped with clamps so that it can be attached to bulbs of various sizes. The fixture is provided with a Cutler-Hammer push-button socket and with a quarter-turn attachment plug, which prevents the cord from twisting while it is inserted into the socket. The fixture is 11.5 in. high and can be folded so as to be placed in a box 5 in. square.

Fifty-Watt Gas-Filled Lamp

In order to supply the foreign market, the Westinghouse Lamp Company, 165 Broadway, New York, has



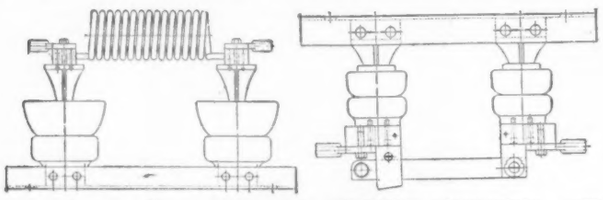
LAMP WITH RATING OF 50 WATTS

developed a 50-watt gas-filled lamp for export only. The lamp, which is shown herewith, operates at from 100 volts to 130 volts and is equipped with a PS-20 bulb.

Choke Coils and Disconnecting Switches

The choke coils, disconnecting switches and fittings illustrated herewith have been brought out by the Electric Service Supplies Company, Philadelphia, Pa., and are designed for use with the Garton-Daniels lightning arresters made by the company.

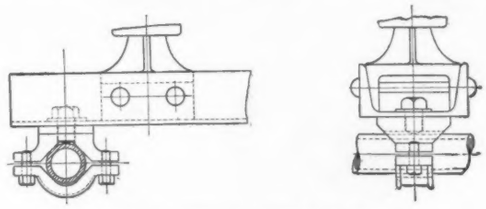
The choke coils and disconnecting switches are made for both upright and underhung mounting for pressures



FIGS. 1 AND 2—CHOKE COIL, UPRIGHT MOUNTING, AND DISCONNECTING SWITCH, UNDERHUNG MOUNTING

up to 35,000 volts and for all standard currents. They are equipped with a base of channel iron, either 3 in. or 4 in. wide, depending on the size of coil or switch. Iron pins are riveted into the channel, and insulators cemented to the pins support iron caps, which in turn support the terminal blocks, terminals and coil or switch proper. The channel bases are drilled with 9/16-in. holes in each end and may be mounted on any flat supporting member by bolts or lags. The switches are designed for disconnecting and controlling high-voltage lines, branch feeders, emergency feeders, etc., as well as for lightning-arrester disconnecting switches to disconnect arresters from the line for the purpose of inspection, repair, etc.

The fittings recently developed by the company in-



FIGS. 3 AND 4—PIPE CLAMPS

clude malleable-iron pipe clamps for mounting switches or coils on either parallel or transverse piping, disconnecting-switch locks designed particularly for use with the underhung type of switch to prevent the blades from blowing open, disconnecting-switch stops for preventing the blade of a switch opening beyond a certain angle, switch-blade operating attachments for facilitating the opening of the switch in an emergency, and disconnecting-switch hooks of lengths varying from 4 ft. to 12 ft. for operating the switches.

Worm-Gear Speed-Reducing Device

In the accompanying illustration is shown one of six machines recently shipped to the Panama Canal Zone for operating signals. The outfit consists of an 0.25-hp. alternating-current motor connected to a worm-gear speed-reducing device. Apparatus of the same type has been developed by the manufacturers, Roth Brothers & Company, Adams and Loomis Streets, Chicago, for use

ALTERNATING-CURRENT MOTOR WITH WORM-GEAR SPEED-REDUCING DEVICE

with both alternating-current and direct-current motors. Speed reductions as great as 100 to 1 can be obtained, it is claimed. The device is designed for a minimum speed reduction of twenty to one. The back-bearing bracket of the motor is part of the worm-gear casing, and the worm is mounted on the shaft of the motor. The worm is provided with thrust bearings, and both the worm and

the worm-gear wheel run in oil, so that the wear and friction are reduced to a minimum. The outfit is so arranged that it is possible to use a standard armature and a standard motor with the exception of the feet on the frame. The manufacturers point out that the apparatus is especially well adapted for use with signals, curtain hoists, electrotypers' rocking tubs, small packing conveyors, bakers' conveyors, dummy elevators, etc.

Anchors

Anchors of the screw, drive, and "ant-hill" type, shown in the accompanying illustrations, have been developed by the Dicke Tool Company, 61 Broadway, New York. The screw anchor shown in Fig. 1 is of solid open-hearth steel, the eye being made without welding. The helix or screw is forged to the shaft. The device is galvanized by the hot-dip process. The lower cutting

FIGS. 1 AND 2—SCREW AND DRIVE ANCHORS

edge is made on an involute curve which, it is claimed, will force stone and other obstacles out of its path. The edge is sharpened so that it will cut roots.

The wings of the drive shaft illustrated in Fig. 2 are of forged steel and are attached to the shaft by rivet lugs. The wings are curved at the end, so that at the first pull they tend to open outwardly, and the greater the pull the deeper the wings are fixed until they come to a position where the maximum resistance is exerted, where they remain fixed. The anchor may be obtained finished in black enamel or galvanized by the hot-dip process.

The ant-hill anchor illustrated in Fig. 3 is of cast-iron and is finished in black enamel. It is usually installed

FIG. 3—ANT-HILL ANCHOR

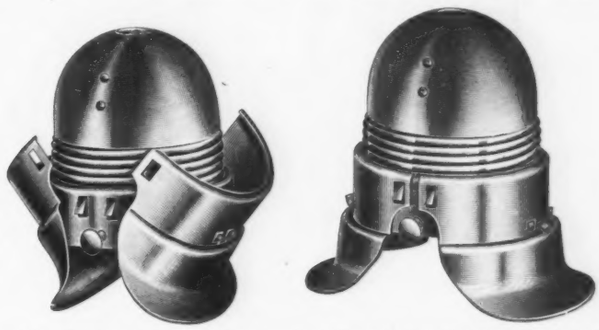
by boring a hole not less than 5 ft. deep with an auger of the same diameter as the anchor. The anchor is then dropped in the hole and the hole is filled with earth, which is well tamped. Connection is made to the anchor by means of a rod.

Screwless Socket Covers and Shade Holders

Fig. 1 is a sectional view of a screwless socket cover and shade holder, showing the glassware supported from the inside and resting on flanges of the inner part of the holder instead of being held with screws by the lip in the usual manner. The holder with cover removed is

FIG. 1—SECTIONAL VIEW OF HOLDER WITH GLASSWARE

shown in Figs. 2 and 3. It is provided with two wings which are hinged on three prongs. They are held in place by two catches attached to a spring strip which is riveted to the holder. A button is attached to this strip by means of which the wings can be released and inserted in the opening of the glass bowl. The wings



FIGS. 1 AND 2—HOLDER WITH WINGS RELEASED AND IN PLACE

are shown locked and in position to hold the glassware in Fig. 3. A covering screws over the holder as shown in Fig. 1. The device is entirely of brass and is being placed on the market by the Plume & Atwood Manufacturing Company, Waterbury, Conn.

Metal-Covered Cable for Automobiles and Motorboats

The Standard Underground Cable Company, Pittsburgh, Pa., is manufacturing various kinds of armored

ARMORED CABLE FOR AUTOMOBILES AND MOTORBOATS

ignition, lighting and starting cable for automobiles and motorboats. The armor consists of a strong D-shaped ribbon wound closely over the cable and is supplied in yellow, antique or nickel-plated finishes. Galvanized-steel armor is occasionally used, though it is of some-

what less durable construction. The insulation of the armored cables consists of high-grade rubber, varnished cambric, and waxed and varnished braids. Other types have plain rubber insulation without the braided covering. The outer braid of the braided cable is covered with several coats of special varnish, which gives it durability, it is asserted, even without the metal cover.

Oil Switch for Induction Motors

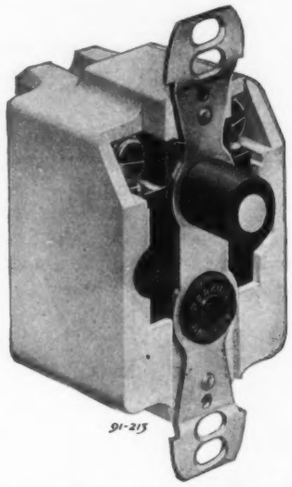
An oil switch designed for use with induction motors in industrial service and operating at pressures up to 2400 volts and currents up to 300 amp. has recently been placed on the market by the General Electric Company, Schenectady, N. Y. The switch can be mounted on a wall or post, or, by means of suitable supports, even on the machine which is operated by the motor. It is being made in both the non-automatic and automatic forms. The latter type is utilized to open automatically the circuit when the overload is greater than that for which the overload trip is set. A low-voltage trip can be added to the automatic switch as an attachment, and to the non-automatic switch either a low-voltage trip or a

2500-VOLT OIL SWITCH, WITH SELF-CONTAINED TRANSFORMER FOR LOW-VOLTAGE RELEASE

series-overload trip, or both, can be added whenever desired. Both tripping mechanisms are mounted inside the switch cover. For switches with ratings up to 550 volts (except those on 110-volt, sixty-cycle circuits where only the trip coil is sufficient) an auto-transformer is employed in place of the usual resistor in series with the low-voltage tripping coil. The transformer is provided with taps to which proper connections can be made for the operating voltage. For 2200-volt circuits a voltage transformer is employed. According to the manufacturer, the energy loss in the low-voltage device is practically negligible. A cast-iron guard is employed for switches equipped with time-limit overload trips. The switches can be equipped with covers arranged to mount a round-type ammeter if desired.

Two-Button Push Switch

In the accompanying illustration is shown a two-button push switch of simple design and construction recently developed by the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. While the action is positive and quick, the manufacturer asserts, the movement of the button is less than 7/16 in., the button in the outer position projecting only 0.5 in. beyond the base plate. A fiber shield is employed to exclude dust and dirt from the mechanism during and

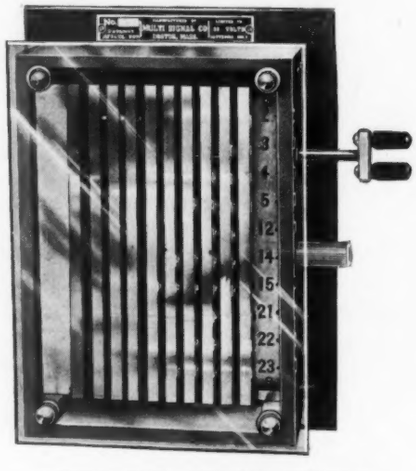


COMPACT TWO-BUTTON PUSH SWITCH

after installation, until the face plate is applied. It is placed in position by the supporting yoke. The "Capax" switch, as it is called, is rated at 10 amp. at 125 volts and 5 amp. at 250 volts.

Multi-Call Signal System

In the accompanying illustration is shown an apparatus for directing men in an establishment to come to the office or answer a telephone, and for other similar purposes. To operate the device the plug is inserted opposite the number which is designated for the man wanted, and the handle is given a slight twist. A signal is then sounded on all the bells in the building or plant, being repeated as often as desired. The apparatus shown is mounted in a Monson slate case and is equipped



MULTI-CALL CENTRAL STATION

with a plate-glass cover. The system can be employed with batteries or 110-volt direct current or alternating current obtained from an ordinary lighting circuit. For the latter purpose a relay is required. The system has been developed by the Multi Signal Company, 7 Sherman Street, Boston, Mass.

CURRENT NEWS SECTION

Meeting of the Canadian Electrical Association at Ottawa

A meeting of the Canadian Electrical Association was held in the Chateau Laurier, Ottawa, on June 26. Class "A" member companies only were represented. About fifty companies, including practically all the important properties, had representatives present. The report of Col. D. R. Street, the president, outlined the work accomplished during the last year. The secretary, Mr. Alan Sullivan, gave various details of the activities of the association.

The results of the method of co-operative purchasing which was inaugurated about three months ago were described as most satisfactory, and the secretary was instructed to secure special prices on further requirements of member companies, and also to investigate carefully and report as to the opportunity for securing a reduction in premiums through the co-operative method of placing insurance.

A full account was given of the formation of the Electrical Employers' Association, an offshoot of the Canadian Electrical Association. The new organization was formed under the terms of the workmen's compensation act in Ontario, and it is accepted by the government as representative of the entire electrical industry. It appoints its own inspector, who makes periodical visits to central-station plants and also manufacturing establishments, investigates accidents and their causes and possible obviation, and in general devotes himself, under the direction of the association, to the purpose of effecting the greatest possible improvement in the conditions under which all electrical workers in the Province are engaged.

The financial statement was read and formally adopted. Very marked progress was shown to have been made during the last year. Many reports were read, and discussions on their interesting features were participated in by the delegates.

An address was then given by Mr. Walter Neumuller of the Municipal Ownership Publishing Company, New York. This proved to be of great interest to those present. The nominating committee, amid the hearty applause of the members, asked that Colonel Street retain the chair for another year. Other officers appointed were: Mr. D. H. McDougall, assistant to the manager of the Toronto Electric Light Company, first vice-president; Mr. W. S. Robertson, general manager Electric Power Company, Ltd., Toronto, second vice-president; Mr. W. G. Matthews, manager Quebec Railway, Light. Heat & Power Company, third vice-president; Mr. Alan Sullivan, secretary-treasurer. New members of the managing committee are: Messrs. W. M. Hopper, manager St. John Railway Company, St. John, N. B.; A. Monro Grier, Canadian Niagara Power Company, Niagara Falls, Ont.; M. C. Gilman, sales manager Toronto Electric Light Company, and James B. Woodyatt, manager Southern Canada Power Company.

A vote of thanks to the officers and committees of the past year was carried unanimously, and the meeting adjourned.

In the evening a dinner was given to the delegates at which a prominent director of the Ottawa Electric Company proved himself a past master in sleight-of-hand tricks.

Cincinnati Franchise Negotiations

The light committee of the City Council of Cincinnati has given to the city solicitor its ideas of an electric rate ordinance, which include a minimum monthly charge of 75 cents, free lamp renewals, and a contract with the Union Gas & Electric Company for ten years, with the privilege to either party of readjusting rates at the end of five years, beginning on Aug. 1, 1915. President Freeman of the company attended the committee meeting at which the report was considered. Mr. Freeman has issued a statement stating that the company could not accept such an ordinance as that outlined. The present maximum rate of 10 cents per kw.-hr. with a 5 per cent discount was suggested as the lowest one possible from the standpoint of the company.

Merger of Buffalo Companies Authorized

The New York Public Service Commission, Second District, has approved the merger of the Buffalo General Electric Company with the Cataract Power & Conduit Company. The opinion was written by Commissioner James O. Carr. The merged companies will be operated under the franchise of the Buffalo General Electric Company in accordance with the provisions of the resolution of the Common Council of Buffalo adopted on Jan. 20-25, 1915. This provides for a reduction of 19 per cent in rates.

The opinion calls attention to the fact that the electrical energy which is used by the companies in Buffalo is obtained from the Niagara Falls Power Company. At the time the rate cases were pending the Cataract Power & Conduit Company sold, and at the present time it sells, electrical energy at wholesale obtained from the Niagara Falls Power Company in Buffalo, and the Buffalo General Electric Company in turn sells electrical energy which it purchases from the Cataract company at retail in the city. In some instances the former company also does some business which might properly belong to the Buffalo General Electric Company with consideration of the sale of energy at retail as distinguished from wholesale. The Cataract company sells a large amount of its energy to the Buffalo company, and in many respects, says Mr. Carr, it might properly be considered as the middleman in the sale and distribution of energy generated by the Niagara Falls Power Company and sold in Buffalo. The opinion adds:

"There is no reason why the business in the city of Buffalo cannot be handled as well by one company as two, and in fact it is the general experience that in situations of this sort it is undoubtedly better for all concerned, the public as well as the companies, if there is but one concern distributing electrical energy in the community. Particularly is this true if the profits of the middleman are wiped out and the public is permitted to participate in the benefits thus obtained. While it is true that the two companies in question do not at the present time compete with each other to any extent, yet it may readily be imagined that a situation might arise whereby there would be a severe competition between them which might create serious difficulties."

No new securities are to be issued. The opinion says in effect: The Buffalo company will issue new securi-

ties only of equal par value to the $2,000,000 outstanding common stock of the Cataract company. No additional bonds of the Cataract company will be issued so that no increase of the outstanding securities of the companies will be made for the specific purpose of merger. The excess amount which the Buffalo company is required to pay to acquire the Cataract stock will be provided by the Buffalo company without the issue of additional securities for that specific purpose. While the petitioner asks for the right to pay as much as $145 a share for the Cataract company stock plus interest at 6 per cent from Dec. 1, 1913, yet, in view of the fact that the liquid assets of the Cataract company are only about $41 per share, the Buffalo company is to be limited to a purchase price of $141 per share for the Cataract company stock. On this basis the Buffalo company would issue for the $1,005,000 Cataract company stock held by the Niagara Falls Power Company an equivalent amount of first refunding 5 per cent gold bonds and would pay the balance of $41 per share plus interest on the purchase price in cash. Likewise, for the remaining outstanding stock the Buffalo company would issue similar bonds at par for a like amount, or if the holders prefer they may accept common stock of the Buffalo company par for par, the balance of $41 per share with interest on the purchase price from Dec. 1, 1913, to be paid in cash.

The order authorizes the Buffalo company to guarantee the $1,384,000 outstanding bonds of the Cataract company. On other points Commissioner Carr says:

"The papers also show that a new power contract will be entered into with the Niagara Falls Power Company which will put the company formed by the merger in as good a position in respect to the purchase of power as the Cataract company now occupies, and this is undoubtedly of value to the companies.

"Another ground of opposition at the hearing was the fact that the Buffalo company proposes to issue its securities in payment for the stock of the Cataract company, and that this ought not to be done because the commission decided in the Cataract rate case that none of the stock had been issued for cash or an equivalent in property. There was no dispute as to this fact, and the books of the Cataract company clearly showed it. Notwithstanding this, it was strongly contended by the Cataract company that the rights obtained by the issuance of this stock did have a substantial value. However, the situation now presented is such that the commission may properly require the companies, if this merger or consolidation is to become effective, to write off a substantial portion of the intangible value which represents the stock, and, in the opinion of the commission, this can be accomplished to a very large extent by requiring as one of the conditions of the merger that this intangible value should be written off to the extent of $1,384,000, which is the amount of the par value of the bonds of the Cataract company now outstanding, and the order will so provide."

The order of the commission follows the provisions outlined in Commissioner Carr's opinion. The consolidation is to be effected before Sept. 1.

New York Investigating Committee Resumes Activities

The committee appointed at the last meeting of the New York Legislature to investigate the Public Service Commission has recommenced its activities. Senator George R. Thompson, chairman of the committee, says that the preliminary work of the committee has been completed and that the chief labor, the revision of the public service commissions law, will begin about July 15.

Electricity in Advertising Pageant at Chicago

In the elaborate night pageant which opened the convention of the Associated Advertising Clubs of the World at Chicago, June 21, many handsome electrically lighted and electrically propelled floats were exhibited, including two displays by the Commonwealth Edison Company, one of which is shown herewith. Both the

COMMONWEALTH EDISON FLOAT IN ADVERTISING PARADE AT CHICAGO

decorations and costumes on this float were of classical design, while the central feature, a huge lamp, symbolized "Edison service." In addition to the lighting of the various floats from the truck batteries, huge searchlamps were installed on roofs of buildings at certain parts of the route to illuminate the displays. The procession required about two hours to pass a given point.

The Second Pan-American Scientific Congress

BY GLEN LEVIN SWIGGETT*

During the present year two great Pan-American gatherings convene in Washington under the auspices of the United States government. The first, the Pan-American financial conference, occurred during the week of May 24. Of greater interest to the educational world, however, is the scientific congress that will convene in Washington beginning on Dec. 27, 1915, and concluding on Jan. 8, 1916. Through the splendid cooperation of the Latin-American countries the second Pan-American scientific congress, likewise held under the auspices of the United States government through the Department of State, bids fair to be not only the greatest Pan-American Congress thus far, but the most important international scientific congress ever held in the United States. The first congress of this name was held in Santiago, Chile, in 1908. It had its origin in earlier Latin-American scientific congresses, and at the time of the Santiago congress, through the generous initiative of the Latin-American countries, was enlarged to include the United States. This congress was well attended by visiting delegates from the United States; on its adjournment Washington was designated, with no solicitation on their part, as the place of meeting of the second congress.

The present European war has brought the Western Hemisphere suddenly face to face with grave economic problems that invite the serious attention of scientists and experts in the various fields of applied science. The scientific congress will concern itself with the constructive discussion of these as well as with the

*Assistant secretary of the congress.

contributions in the domain of pure science, wherein great advance has been made since the last congress in Santiago, Chile. Science is defined comprehensively by the congress and includes, under nine heads, such main subjects as anthropology, astronomy, meteorology, and seismology; conservation of natural resources, agriculture, irrigation, and forestry; education; engineering; international law, public law, and jurisprudence; mining and metallurgy, economic geology, and applied chemistry; public health and medical science; transportation, commerce, finance, and taxation.

Mr. John Barrett, director-general of the Pan-American Union, is secretary-general of the scientific congress. The sessions of the congress will be held in the Pan-American Union Building.

Trade-Mark Registration in Latin America

The attention of American manufacturers has been called repeatedly to the necessity of trade-mark registration in foreign countries, especially where priority of registration is the basis for ownership, and some American manufacturers have had to pay considerable sums for the right to use their own trade-marks, which had been registered by their enterprising agents. The Bureau of Foreign and Domestic Commerce has been interested for many years in the protection of American trade-marks in foreign countries, and within the last few months it has established a separate section devoted to the distribution of information in regard to trade-mark and patent laws in foreign countries. Tariff Series No. 31, issued by the bureau, is intended to give American manufacturers an approximate idea of the formalities and cost of registering a trade-mark in Latin-American countries.

Organization of Building Data League

The Building Data League, Inc., has been formed as an association of consumers for the purpose of securing through co-operation exact and reliable information as to the quality and relative economic values of the vast number of materials, methods and devices offered for use in the construction and equipment of buildings. The officers are Messrs. Lansing C. Holden, chairman; Charles L. Borie, Jr., first vice-chairman; James S. MacGregor, second vice-chairman; Sullivan W. Jones, secretary, and Frank Sutton, treasurer. Mr. Thomas M. Debevoise is counsel.

The members of the board of governors are Prof. Arthur H. Blanchard, Mr. Charles L. Borie, Jr., Mr. Frederick A. Burdett, Prof. William Campbell, Mr. John T. Corcoran, Mr. Job R. Furman, Mr. Carl F. Grieshaber, Mr. Lansing C. Holden, Mr. Bassett Jones, Mr. Sullivan W. Jones, Prof. James F. Kemp, Prof. Charles W. Killam, Mr. Gustav Lindenthal, Mr. Clay M. McClure, Dr. Parker C. McIlhiney, Prof. J. S. MacGregor, Mr. Henry C. Meyer, Jr., Mr. James P. Millwood, Mr. William Stanley Parker, Mr. Frederick W. Perkins, Dr. Allen Rogers, Mr. William A. Sanders, Mr. Frank Sutton, Mr. Stephen F. Voorhees and Mr. George H. Wells. The headquarters are at 105 West Fortieth Street, New York.

The league is similar to other national organizations not operated for profit. It goes farther, however, than these organizations, having affiliated with it and immediately under its complete control a secondary corporation known as the Building Data Company, Inc., which conducts investigations, retains experts where necessary to make investigations, and will, it is hoped, in time have its own laboratories.

The purpose of the league is to establish market standards in the building industry in order that demands may find definite expression. It accepts such standards of quality as are established by recognized authorities, but where standards are lacking the league will establish them for its use through co-operative research, investigations and examinations with producers, and products will be given a market rating with regard to their value measured by such standards.

A statement of the function and service of the league says that the commercial race between producers in the field of building has been run to exhaustion. Now the first whisperings of a new commercial spirit, a desire among competitors to deal honestly and openly with one another, are being heard. There is an awakening to the fact that the foundation of economic success is the co-ordination of efforts rather than strife.

The league will make investigations on classes of products and, through the work of its technical committees, establish standards for gradations of quality. In order that these standards may become effective, the league will prepare for the use of its members standard specifications which will define quality accurately, making proper distinctions between the several established grades. These specifications will supplement the work done by the Bureau of Standards, American Society for Testing Materials, Underwriters' Laboratories, Inc., National Fire Protection Association, etc.

The league's investigations comprise the following considerations from which ratings are determined: (1) performance of product under service test; (2) production, including raw materials, shop practice, plant efficiency, capacity, organization and deliveries; (3) market, including demand, adaptability, cost, difficulty incident to installation, and service efficiency; (4) sales, including character and reliability of advertising matter and claims, selling tactics, producer's attitude toward his market, organization, and financial responsibility. The producer is required to meet the expense of the investigation.

Among the committees for the first year are those on fireproofing and fire protection, protective coatings, waterproofings, electrical devices and equipment, mechanical devices and equipment, insulation, and building codes.

Any individual or person as a representative of a firm, corporation or association who or which is a nonproducer of materials, devices, methods or apparatus entering into the construction or equipment of buildings or the improvement of real property is eligible to membership. The annual dues for membership are $9 and a subscription of $1 for a monthly bulletin. There is no initiation fee.

Preventing Vandalism in Louisville

Recent frequent recurrences of globe smashing and cutting of ground wires and pipes connected with the Louisville Gas & Electric Company have prompted Mr. Donald McDonald, the vice-president and general manager, to attempt to get the public sufficiently interested to co-operate with the company and the police in preventing such vandalism. He points out the danger of interruption of the grounding circuit of the lightning arresters and says that the other offense is costly, dangerous and an annoyance for everybody.

The company has offered rewards for the apprehension and conviction of anyone who commits either of these acts of vandalism. Mr. McDonald wrote to the daily newspapers in the hope that through them he would secure the co-operation of the public in preventing such acts.

Electrical Fourth of July in New York

A committee appointed by Mayor Mitchel of New York has made plans for effective illumination on the Fourth of July. An appropriation was made to carry out this purpose in the various boroughs composing Greater New York, but the central-station companies will meet the deficiency and do much to provide attractive displays in numerous parks. Many more small parks will be illuminated than has been the practice in previous years, when illumination effects have been confined largely to a few of the more extensive parks. Various local organizations are co-operating with the committee, which represents local central-station companies. The effects in public parks will be supplemented by private displays. The members of the committee are Messrs. Arthur Williams, chairman; George B. Cortelyou, Nicholas F. Brady, Frank W. Smith, C. G. M. Thomas, J. E. Phillips, W. F. Wells, W. J. Clark and E. H. Rosenquest.

Engineering Societies Co-operate in Fourth-of-July Celebration

West Thirty-ninth Street between Fifth and Sixth Avenues, New York City, will be closed to traffic on the Fourth of July for a celebration by the Vacation Headquarters, a feature of which will be street dancing, as in Paris. The authorities of the Engineering Societies Building have given permission for the erection of a band stand and a huge screen on which motion pictures will be projected. Mr. Arthur Williams, who is a member of the advisory committee of the Vacation Headquarters, has arranged for the special illumination of the street during the evening.

Electrical Exports in April

Electrical exports in April are reported by the Bureau of Foreign and Domestic Commerce as follows:

Articles	April		Ten Months Ended April	
	1915	1914	1915	1914
Batteries	$88,372	$65,001	$773,578	$269,808
Dynamos or generators	127,071	176,469	1,737,513	2,157,145
Fans	61,926	38,525	181,365	381,633
Insulated wire and cables	354,344	86,993	1,356,574	1,826,482
Interior wiring supplies, etc., including fixtures	67,605	60,891	550,836	614,732
Lamps:				
Arc	554	1,063	27,958	70,060
Incandescent:				
Carbon filament	27,665	4,621	82,898	162,958
Metal filament	36,936	20,820	352,381	191,688
Meters and other measuring instruments	69,835	.....	331,889	.....
Motors	193,802	341,369	2,324,806	3,897,324
Static transformers	47,763	93,247	530,723	1,330,487
Telegraph instruments (including wireless apparatus)	14,377	8,654	72,781	104,561
Telephones	89,730	73,061	1,047,929	1,280,255
All other	875,395	770,837	6,551,236	8,982,554
Total electrical exports	$2,055,375	$1,741,551	$15,922,467	$21,569,687

Testing the Interest in Electricity

To test the interest in electricity in small communities, the Society for Electrical Development has sent notices to a few papers of general circulation in the towns and small cities selected, stating that it will award $25 cash for the best definition of "electricity" received up to Aug. 1, 1915. The replies are to contain at least twenty-five words and not more than forty words. A committee to act as judge has not yet been appointed.

As one of the details in its plan for "Electrical Prosperity Week," Nov. 29 to Dec. 4, the society has conducted a contest and selected one of the contestants who submitted a photograph to act as a model for the Goddess Electra.

Federal Trade Commission Affairs

It has been necessary for the Federal Trade Commission to "lay off" a number of employees at the beginning of the Government's fiscal year, July 1, for lack of appropriations for their salaries. This, it is understood in Washington, will mean a severe handicap to the commission, with no relief in sight until Congress reassembles in December and votes more money for the payment of employees. In many cases those who remain will be obliged to "double up" on the work, so that headway may be kept.

The attitude of the Department of Justice toward the possibility of prosecutions under the Sherman law continues to be a subject of deep interest in Washington. The indifference in administration circles, particularly the Department of Justice, to the recent court decision indicating that the United States Steel Corporation is not violating the Sherman law is explained by high officials as due to the fact that if the Steel corporation or any other large industrial combination is guilty of evasions of the law there will be no trouble in reaching it under the anti-trust laws passed by the last Congress for the enforcement of which the Federal Trade Commission is responsible.

While it is not the intention of the Federal Trade Commission or any other part of the administration to proceed against violators of existing trust laws in a sensational manner, it is the belief of high officials that the commission will be able to take effective steps at intervals to prevent a growth of monopoly in any large combination. Neither the commission nor the President will hamper the large industrial combinations; on the contrary, they want to encourage business, but it is known in Washington that it is the purpose of the commission to eradicate quietly all schemes, wherever they crop up, which tend to foster monopoly and unfair practices.

Missouri Commission Decision in Charleston Case

The decision of the Missouri Public Utilities Commission on the complaint of the Commercial Club of Charleston against the Missouri Public Utilities Company and on the valuation of the electric plant of the company has been issued. The fair present value of the property used and useful in the city for determining reasonable and just rates was fixed as of May 31, 1914, at $58,000. Upon this valuation the commission decides that a net return of at least 7½ per cent justifies maximum rates in substance as follows: Residence lighting, first 20 kw.-hr., 12 cents per kw.-hr.; next 20 kw.-hr., 10 cents per kw.-hr.; over 40 kw.-hr., 4 cents per kw.-hr.; minimum charge, 75 cents. Other than residence lighting, first 30 kw.-hr. of connected load, 12 cents per kw.-hr.; next 30 kw.-hr., 10 cents per kw.-hr.; over 60 kw.-hr., 4 cents per kw.-hr.; minimum charge, $1.

A complaint of excessive charges and unjust discrimination in the sale of ice was eliminated on the ground that the commission is without jurisdiction.

Relatively enormous amounts brought to the attention of the commission as opinions and lump-sum estimates for intangible and going values by their very excessiveness render these methods practically impossible as measures of value. An allowance of $110 for amortization of the cost of the proceeding is made as an operating expense, though such allowance, the commission holds, might appear more properly under contingencies.

Cleveland Municipal Plant Developments

Commissioner of Light and Heat F. W. Ballard of Cleveland, Ohio, announced on June 23 that he had instructed solicitors for the municipal electric plant not to seek any more large motor-service contracts. The plant is loaded to such an extent, he said, that it would be inadvisable to use the remaining day possible output for motor service. It is loaded to more than one-third of the total rating now, and even with present connections will be loaded to more than one-half of its rating in the winter, while the peak load will reach two-thirds of the rated output. For this reason he wants to retain the remaining generating ability for domestic service, which is growing where lines are installed.

There has been some discussion as to whether the Cleveland Electric Illuminating Company would be asked to bid on the street lighting in the district now reached by the municipal cables, but this is not regarded as probable, since the city officials will be able to make a rate that will be commensurate with the cost of production, to which such profit may be added as will cover the city's proportion of the fixed charges. There will be about 600 lamps, but the style of standard has not yet been decided definitely. About 450 of the lamps will be on until midnight and the remainder the entire night.

A resolution was introduced in the City Council at Cleveland on June 28 giving the Cleveland Electric Illuminating Company authority to lay steam-heating pipes to the new city hall on the lake front. This is the beginning of an attempt to force the company to furnish heat for this building, as the company had already notified Director of Public Service Sidlo that it cannot give the city this service at the rate offered, 30 cents per 1000 lb. The company offered to furnish heat at a rate of 64.3 cents.

Government May Operate Sayville Wireless Plant

As the result of conferences between Secretaries Lansing, Daniels and Redfield, of respectively the Departments of State, Navy and Commerce, the United States government may decide to take the wireless plant at Sayville, L. I., under entire government control during the remainder of the war. New high-powered equipment installed at the Sayville plant recently and the character of the messages sent since the additions were made have raised the question whether the Government shall renew the license of the plant, or whether during the war it shall operate it with United States officers in charge. The Department of Justice holds that the Government has the right to operate the plant to preserve neutrality if necessary. Messages sent recently in plain English are now reported to have contained hidden meanings which might violate United States neutrality. The staff of United States Navy censors at the plant has been increased pending an investigation now being made by the Department of Commerce.

Division of the People's Income

A committee on the division of the people's income has made a preliminary report to the National Civic Federation. The committee consists of Mr. W. J. Pape, Waterbury, Conn., chairman; Prof. John B. Clark, Columbia University, New York, and the Rev. John A. Ryan, St. Paul (Minn.) Seminary.

While the average annual wage in manufacturing industries has increased from $247 to $518 in sixty years, the normal rate of interest, the committee finds, has decreased one-fourth.

The Appraisal of "Overhead Costs"

BY HALBERT P. GILLETTE

Several recent decisions of public utility commissions serve to call attention to a rather general lack of knowledge about overhead costs. The term overhead costs has no generally accepted meaning.

Appraisal engineers usually, although by no means universally, limit the items of construction "overhead costs" to the following: (1) Engineering and inspection; (2) supervision (other than gang foremen and the profits of contractors); (3) organization (preliminary to construction); (4) administration, accounting and clerical; (5) legal; (6) insurance (casualty, fire and title); (7) taxes; (8) interest; (9) contingencies, omissions and waste; (10) brokers' fees; (11) promoter's profit.

I have omitted "going value" or "development cost" from the list of "overheads," and in doing so I follow present practice, although "development cost" is largely interest during construction and its sequel—deficit in interest during the development period.

Practice of Wisconsin Commission

I am informed by Mr. C. M. Larson, chief engineer of the Wisconsin Railroad Commission, that his estimated "overhead costs" exclude items Nos. 6, 10 and 11 of the above list. Item No. 6, insurance, is included in the unit prices that he uses. Item No. 10, brokers' fees, is taken into consideration by the Wisconsin commission (as I interpret the decisions) in arriving at the proper rate of "fair return" on the investment, since brokerage fees commonly constitute part of the discount on bonds. Item No. 11, promoter's profit, appears not to receive recognition by the Wisconsin commission. Mr. Larson informs me that he usually adds to the direct costs 15 per cent for overhead costs on "the larger properties which show a high type of construction," and he intimates that of this 15 per cent very little constitutes item No. 10, or contingencies, because his "inventories are usually made quite complete by means of co-operation of the officers and agents of the companies." For small plants Mr. Larson commonly allows 12 per cent for overheads. These percentages—12 and 15—seem very low, and I believe they are low where a utility company does most of the construction with its own forces. Mr. Larson, however, uses unit prices that are assumed to be fair contract prices for the plant "in place," which puts a somewhat different light on these low overhead percentages. As to unit prices, he says: "These prices cover contractors' profits, liability insurance and, in a word, every item which is ordinarily in the same to a general contractor."

Since a general contractor is a business manager, and since his sub-contractors are really superintendents, it follows that, when their services are paid for in the form of profits included in their unit prices, items Nos. 2 and 4, supervision and administration, are smaller than where a company does the construction with its own forces. This alone explains a considerable part of the difference between percentages estimated by different appraisers for overheads. In my appraisals of electric railways, electric power and light properties, and telephone plants, knowing that many companies do most of their construction with their own forces, I have used unit prices that often included relatively little or no supervision (other than gang foremanship). Even in these cases it happens occasionally that a manufacturing company undertakes to do much of the engineering and supervision involved in laying out and installing apparatus, and then a large part of such "overheads" as engineering and supervision is automatically buried in the prices charged for apparatus installed "in place."

Land and right-of-way are accounts that ordinarily must carry very heavy "overheads" in the form of interest and taxes during construction, to say nothing of title insurance, legal and other expenses.

I find that some utility companies include "dead time," traveling expense, unapportioned freight and cartage, and the like, under item No. 2, supervision. To put the "dead time" (due to bad weather and holidays) of laborers in this account is, it seems to me, a mistake. Similarly, traveling expense of laborers and unapportioned freight should not be called supervision.

Prorating Costs of Renewals and Additions

Most large companies build additions to plant at the same time that they make repairs and renewals. Often the same gangs make both renewals and additions simultaneously. The same engineering, managerial and executive forces are usually engaged in maintenance as well as on new construction. Therefore it becomes necessary to prorate engineering, supervision, etc., to two or more distinct classes of work. Such prorating may be done according to different theories, the two most common being: (1) in proportion to the cost of direct labor, and (2) in proportion to the combined cost of labor and materials. These two methods rarely give the same results; often the results are widely different. Maintenance work generally involves a relatively high proportion of labor to material costs, whereas the converse is often true of new construction.

While most engineers are fairly familiar with contract prices, and while some are equally familiar with actual unit costs, relatively few know from personal study of accounts what overhead costs average under given conditions. The consequence has been that engineers employed by public service commissions have commonly underestimated overhead costs. Engineers employed by companies have ordinarily been closer to the mark, but occasionally have grossly overestimated overhead costs because they were guessing.

Interest During Construction

Very few operating companies charge any "interest during construction" when new construction proceeds *pari passu* with renewals. In other words, after the original nucleus of a plant is built, the "interest during construction" account, if ever there was one, is closed. Interest during construction, as I now view it, should be charged at the full "fair return rate" rather than at the bond interest rate. Otherwise the investor fails to get a "fair return" on his money during the construction period.

It has often been claimed that bond discount is a proper "overhead charge," but usually this claim has been rejected by commissions. Bond discount is a composite of two entirely distinct things, (1) brokerage fee and (2) advance payment to the bond purchaser. Occasionally a witness who has testified as to brokerage fees is asked such a question as this: "If Jones builds a ten-thousand-dollar house with his own money, whereas his next-door neighbor, Smith, builds a ten-thousand-dollar house with borrowed money, is Smith's house worth more than Jones's?" The answer is no, and upon receiving such a reply it is presumed that the entire argument in favor of brokerage as an overhead cost is overthrown. But let the cross-examiner himself be asked: "If Jones, who is an architect, builds a house, and his neighbor, Smith, who is not an architect but hires one, builds a duplicate house, is Smith's house worth more than Jones's?"

Here the negative answer might with equal reason be used to support the contention that architects' fees are not a proper overhead charge. The fallacy in this line of reasoning arises from the confusion of cost with value. While neither interest during construction, nor taxes, nor brokerage fee, nor many another item adds to the commercial value of a property, it does add to its cost.

Contingencies

Perhaps at the basis of the phenomenon of underestimating contingencies there is the psychological fact that most men are optimists. The hope that work can be done cheaply is father to the too low estimate. In not a few articles, decisions and books on appraisals there appear diagrams and tables of unit prices of materials, accompanied by statements that the average of these prices over a period of years was used as the base price in the appraisal. This seems a philisophical method to use when average prices are sought, but closer investigation discloses the fact that it is not so philosophical as it seems. In general, average weighted prices are higher than average unweighted prices, because more materials are bought during periods of high prices than during periods of low prices—the higher prices being, as a matter of fact, the result of the greater demand.

Another common cause of underestimates by engineers is traceable to their lack of familiarity with the detailed records of the accounting department. Until one knows just what an appraiser has included in his unit prices it is impracticable to compare most of the overhead costs of two different appraisals. Even the same words used to designate overhead items are not always used in the same sense. "Engineering" may or may not include inspection, architects' fees, office expenses incident to engineering, etc.

"Office expenses" may or may not include interest and taxes on the office floor space. These fixed charges on office buildings, etc., are sometimes overlooked entirely. At other times they are cared for under interest and taxes. Again at other times they are distributed among other overhead items.

Full Knowledge Necessary

As indicative of the errors that are being made through rather blindly adopting overhead percentages used by other appraisers without also understanding what their unit costs contain, I will quote again from one of Mr. Larson's letters to me:

"Some commissions in the Southwest have been known to quote the Wisconsin commission as putting on only 12 to 15 per cent [for overhead costs], which they declare covers not only the items enumerated but also promotion, discount on bonds and going value. I wish to mention this only that it may call to your mind the fact that these overhead charges are not intended to cover such items.

"It should be noted that when a telephone company purchases a switchboard the cost of a large part of the engineering on that switchboard is included in the price paid the supply company. When a gas company purchases a gas tank, the cost of a large part of the engineering is paid to the supply company. Since we [the engineers of the Wisconsin Railroad Commission] place the price of these items at the amount paid by the local companies to the supply companies, this fact must be taken into account in applying our overhead charges."

I would caution against the assumption that the foregoing is more than an outline of the theme of this article. Prorating indirect costs, which are so closely associated with overhead costs, is itself a large and complicated subject. But, depending on the method of prorating general expenses over capital account and operating expense, there will be marked differences in the overhead costs of construction wherever construction is carried on by the same organization that is operating the utility plant.

Miscellaneous News Notes

Galleries for Utility Service Mains.—The Chicago commission on downtown municipal improvements is endeavoring to determine the practicability of constructing galleries for utility service lines beneath the streets affected by the construction of Chicago's new Union Station. The use of galleries will alleviate, it is thought, some of the evils brought about by the present congestion of utility service lines beneath the pavements.

Water-Power Rights in Nicaragua.—According to United States Consul Cornelius Ferris, Jr., Bluefield, Nicaragua, in the Commerce Reports, the government of Nicaragua is too new for questions relating to water-power rights to be entirely settled, and there is a possible source of trouble in conflicting claims; but the intent of the law and the policy of the government, he states, is that water-power, which is abundant nearly everywhere in northeastern Nicaragua, shall be available to develop industries.

Motor Service Contract Advances Price of Stock.—The price of the stock of the Narragansett Electric Lighting Company, Providence, R. I., as a result of the recent contract to furnish electric service for the operation of the manufacturing plant of Brown & Sharpe, rose in the local market from $84.50 to $86 within one week. In the Providence district the feeling predominates that the company is expanding on a sound basis, and that the Brown & Sharpe contract proves that it can furnish energy at lower cost than a large manufacturing firm is able to produce it for use in its factory.

A Fire-Alarm Box to Eliminate False Calls.—Mr. William C. Matthias, chief of the Reading (Pa.) bureau of electricity, has devised a fire-alarm box the purpose of which is to prevent miscreants from turning in false alarms without detection. This improved box contains a 6-in. gong which starts ringing as soon as the box is opened, wakening sleepers in the neighborhood and attracting attention to the box and to the person sending in the alarm. The box is of the keyless type, and the door cannot be closed until the mechanism has been reset by an official, preparatory for the next alarm.

Issues of Patent Office Gazette Delayed for Lack of Funds.—Owing to the unusually large number of patents issued during the latter half of 1914 and the first half of 1915, the regular appropriation of $440,000 and a supplemental appropriation of $125,000 for printing patent specifications and the official Patent Office *Gazette* during the fiscal year became nearly exhausted, making it impossible to issue the *Gazette* for June 15, 22 and 29 on those dates. With the new appropriation which becomes available for the current fiscal year the above issues will be sent out as early in July as the publication thereof can be brought about. Owing to the resulting congestion, Commissioner of Patents Ewing explains that some delay may be expected in the *Gazette* issues for July until conditions in the office of the Public Printer at Washington again become normal. No delay has occurred, however, in the issuance of patents, designs and trade-marks.

Electrical Measuring Instruments.—A second edition of the Bureau of Standards Circular No. 20, referring to electrical measuring instruments, has just been issued. The object of this circular is to present briefly the fundamental principles underlying the construction and operation of commercial electrical measuring instruments, together with such information concerning the advantages and limitations of the various types of instruments as will assist the user in the determination of the general type best suited to a given purpose. The question of sources of error has been treated in some detail, with a threefold purpose: To suggest, first, how some errors may be avoided; second, how corrections may be made for known sources of error; and, third, to furnish suggestions which will assist those who have to specify instrument performance or to select instruments. In view of the increasing number of central stations, public-service commissions and colleges which are equipping testing rooms for the maintenance of electrical standards and the precision checking of electrical instruments, some space has been given to a discussion of the apparatus which seems best suited for use in such laboratories.

Part Played by Electrical Investments in Wealth of Nation.—The recent publication "Estimated Valuation of National Wealth," issued by the United States Census Bureau, places the nation's wealth in 1912 (the latest year considered in the report) at $187,739,071,090. Of this amount $2,098,613,122 is invested in privately owned central electric lighting and power plants, $4,596,563,292 in street railways, $223,252,516 in telegraph systems, and $1,081,433,227 in telephone systems, making a total of $7,999,862,157 in electric utility properties. Thus the value of electrical enterprises represents approximately 4.3 per cent of the total wealth of the nation. Compared with some of the country's other leading industries, the electrical investment is also large. It is approximately 50 per cent of the total value of the steam railroads and the equipment, 33 per cent more than the value of live stock, a little over three times as much as the sum of the nation's gold and silver coin and bullion, about 46 per cent less than the annual value of manufactured products, almost twice the estimated value of clothing and personal adornments, and approximately equal to the value of furniture, carriages and kindred personal property.

Ocean Tides the Cause of Puzzling Voltage Phenomenon.—Troubled because his lamps grew dim for a few hours each day and then as curiously regained their brilliancy, a customer recently called on the Boston Edison company to ascertain the cause. When the company's investigator visited the premises the voltage was normal and no perceptible ground could be detected on the circuit. Before long, however, the phenomenon of the previous days repeated itself. The pressure dropped quite rapidly from 110 volts to 60 volts and remained at that value for several hours, soon rising again, however, in the same mysterious manner. As there were no motors in the vicinity which could cause the drop in pressure, it was decided to connect a recording voltmeter to the line. After this had been left in circuit a few days, the charts revealed the fact that each day the voltage started to fall about 50 minutes later than on the preceding day. As the consumer's property was situated on a wharf, it at once occurred to the inspector that the rise and fall of the tide might in some way be the cause of the trouble. This was subsequently found to be the case, the rise of the salt water having short-circuited the service wires.

Seventh Annual Picnic of Dayton Power & Light Company.—The seventh annual picnic of employees of the Dayton (Ohio) Power & Light Company was held at Kil Kare Park, about 12 miles from Dayton, on June 22. The employees went to the park in cars of the Dayton, Springfield & Xenia Southern Traction Company, which is operated with energy from the Dayton Power & Light Company. A baseball game was played between the different office departments and the outside departments. A victory by the outside departments made them the possessors for the first year of the "F. M. Tait cup," donated by Mr. Tait for annual competition in baseball between the two divisions. Following the dinner a photograph was taken, in which 768 employees and their families appeared. In 1914 approximately 525 attended the picnic. Mr. John Himes, head of the meter department, on behalf of all of the employees, presented to President Tait a solid gold watch on the eve of his departure from Dayton to take up his residence in New York City. The afternoon was given over to athletic events of all descriptions. There were keen contests in all of the events, not only for individual prizes, but for points to determine the possessors of the "Young cup," which was donated by the late A. M. Young for annual competition between the different departments. The cup will be in the possession of the maintenance and construction department this year. The sterling silver medal given to the best all-around athlete was presented to Mr. Richard Pflaum, of the maintenance and construction department. The evening was spent in dancing. The athletic committee was composed of Messrs. M. H. Wagner, chairman, C. P. Garman, R. R. Herkins, O. E. Howland, O. B. Reemelin, F. B. Steele, R. L. Stewart and H. Thompson and Miss Hughes. The officials of the day were Messrs. T. F. Kelly, O. E. Howland, C. P. Garman, L. K. Funkhouser, O. H. Hutchings, O. B. Reemelin, C. H. Spiehler, F. T. Griest and K. L. Fitzpatrick and Miss Hughes.

Associations and Societies

Jovian League of Detroit.—Members of the Jovian League of Detroit held their annual rejuvenation at the Detroit Board of Commerce on the evening of June 23. The attendance was large and twelve candidates were initiated.

Institute of Consulting Engineers.—The meeting of the American Institute of Consulting Engineers, Inc., scheduled to be held on the evening of June 29, at the Engineers' Club, New York, was postponed on account of the impossibility of securing the attendance of a quorum. The next meeting will be held in the fall. There will be many matters of importance to be discussed and decided at that time.

E. V. A. to Convene at Cleveland in October.—At a meeting of the council of the Electric Vehicle Association of America at New York City, June 25, it was voted to hold the 1915 convention at Cleveland, Ohio, next October, the 18th to 20th of that month being selected as the tentative dates. Two new E. V. A. sections were reported organized, one at Kansas City, Mo., and the other at Portland, Ore. The association now has in all sixteen local sections.

Meeting of Cincinnati Electric Club.—The first meeting of the Cincinnati Electric Club since its recent organization was held at the "Zoo" last week, with nearly 100 members present. A dinner preceded several interesting talks by leading members, in which the necessity of co-operation and mutual aid on the part of dealers in electrical supplies, contractors and others in the industry was urged. Messrs. Andreas Burkhardt, president of the Retail Merchants' Association, and Ralph Pingle, president of the Rotary Club, were among the speakers.

Missouri Contractors' Association.—The Electrical Contractors' Association of Missouri will hold its annual meeting at the Kupper Hotel in Kansas City on July 10. The Electrical Contractors' Association of Kansas will also meet in Kansas City on the same day. The two associations will act upon the report of the committee appointed to form a plan of consolidation, and whether or not there is a consolidation a joint meeting will be held by the two associations on this day. The Missouri association will probably change the date of its annual and semi-annual meetings. The plan is to hold the annual session hereafter on the third Saturday in January so that the officers may be elected and delegates chosen to the convention of the National Electrical Contractors' Association in time to become familiar with their duties before the national convention held in July. The semi-annual meeting will be held in either Kansas City or St. Louis at such time before the national convention as is convenient. When the national association is in the West, the July meeting will be in Kansas City; when the national association meets in the East, the July meeting will be held in St. Louis.

Illumination Discussed at Kansas City.—At a special luncheon of the Electric Club of Kansas City at the Baltimore Hotel on June 25 Mr. Preston S. Millar, manager of the Electrical Testing Laboratories, New York, made a talk on the electrical features of the California expositions and the work of the laboratories. Mr. Millar reported his particular impressions of the illumination of the San Francisco fair, which he said made the night scene a distinctive feature, and emphasized the advance in illumination during the last few years. He called attention to the latest tendency of illuminating, toward ornamental effects, one result being that even in residences as many as ten outlets are now thought desirable where one or two in a room were formerly considered sufficient. The increased use of energy furnishes an incentive to central stations as well as to manufacturers and contractors to encourage this tendency. He suggested that Kansas City should have a representative of the Illuminating Engineering Society, who should work in conjunction with the Electric Club or similar organization.

Milwaukee Section, N. E. L. A., Discusses Street Lighting.—Milwaukee's proposed street-lighting system was discussed by city officials, consulting engineers and members of the organization of the Milwaukee Electric Railway & Light Company at the third annual banquet of the Milwaukee Section of the National Electric Light Association, June 29. Mayor G. A. Bading of Milwaukee presided. The civic and business advantages of good lighting were pointed out by Mr. Milton C. Potter, superintendent of schools, and by Mr. Eltinge Elmore, president of the retail merchants' division of the Merchants and Manufacturers' Association. Messrs. Edgar Switzer of the Westinghouse Electric & Manufacturing Company and W. A. Dorrey of the General Electric Company discussed some of the technical details of the equipment. This description was continued with greater detail by the consulting engineer for the system, Mr. F. A. Vaughn of Vaughn, Meyer & Sweet. Mr. F. A. Coffin, commercial engineer of the Milwaukee Electric Railway & Light Company, Mr. Edwin S. Mack of Miller, Mack & Fairchild, attorneys, and Mr. Edwin Gruhl of the North American Company emphasized the changing point of view toward street lighting and the latter's historical, legal and cost phases.

Meeting of Pennsylvania Electrical Contractors.—The Electrical Contractors' Association of the State of Pennsylvania held its fourth annual convention at the Adelphia Hotel, Philadelphia, on June 16. The president, Mr. Frederick M. Shepard of Philadelphia, who presided at the meeting, was also the toastmaster at an informal dinner in the evening. It was reported that the Pennsylvania law requiring separate specifications and direct bids for plumbing, heating, ventilating and electric work on public buildings is observed generally in the State. Messrs. John S. Musser, Harrisburg, and H. G. Kepler, Philadelphia, were named to represent the association on a joint conference committee representing different industries interested in the enforcement of the law. One of the subjects of discussion was the advisability of securing more effective co-operation between the National Electrical Contractors' Association and state and local associations. Suggestions looking to this result will be presented to the national association. The new officers are: President, Mr. John S. Musser, Harrisburg; vice-president, Mr. W. T. Brown, Philadelphia; secretary-treasurer, Mr. M. G. Sellers, Philadelphia; directors, Messrs. George E. Shepherd, Wilkes-Barre, and M. E. Arnold, Philadelphia; national director, Mr. George E. Shepherd. At the dinner addresses were made by Messrs. Frederick M. Shepard, John S. Musser, W. T. Brown, George E. Shepherd, Washington De Vereux, Frank H. Stewart, A. L. Hallstrom, E. Ward Wilkins, C. E. Ludovici and F. P. Groves.

Convention of New York Companies' Section, N. E. L. A.—The New York Companies' Section of the National Electric Light Association, which is composed of the employees of nine companies operating in and around New York City, held its annual convention at the Hotel Astor on June 30. The meeting was the largest ever held by the section, over 400 being present. The afternoon session was opened with an address by the chairman, Mr. J. E. Phillips, which was followed by the reports of the secretary, treasurer and publication committee. Various résumés of different phases of the activities and proceedings of the recent national convention at San Francisco were presented, after which the election of officers for the ensuing year was held. At the banquet in the evening more than 750 attended. Among those present were Mr. E. W. Lloyd, the newly elected president of the N. E. L. A., who outlined some of the policies of company sections. Mr. H. H. Scott, the retiring president, also spoke briefly. Mr. J. W. Lieb, vice-president and general manager of the New York Edison Company, gave a forceful address on "Public Service Commission Regulation of Public Utilities." Mr. C. G. M. Thomas, president of the New York & Queens Electric Light & Power Company, spoke from personal experience on the "Relative Values of Men." Dr. B. W. Stillwell, vice-president of the Westchester Lighting Company, described the lighting at the San Francisco Exposition. Mr. F. W. Smith, vice-president and general manager of the United Electric Light & Power Company, Mr. H. L. Snyder, treasurer and secretary of the New York & Queens Electric Light & Power Company, and Mr. H. M. Edwards, auditor of the New York Edison Company, also addressed the convention briefly. The following officers were elected for the ensuing year: Chairman, Mr. F. C. Henderschott; vice-chairman, Mr. L. A. Coleman; treasurer, Mr. W. L. Bruce; recording secretary, Mr. John Burke; executive secretary, Mr. Ralph Neumuller. The executive committee is composed of Messrs. Stuart Wilder, I. M. Beatty, Carleton Macy, J. E. Phillips, Alexander Maxwell, F. W. Smith, W. L. Secord, G. B. Cornell and Edward B. Fielis.

Public Service Commission News

New York Commissions

On a memorandum by Commissioner Carr the Second District commission has approved the application of the Middleville Electric Light Company for permission to construct lines in Newport and to exercise rights and privileges under a franchise therefor. The application was opposed by the Newport Electric Light & Power Company, which claimed that it had been given a similar franchise by the town authorities. It was admitted that the chief purpose of the new lines was to give service to the Herkimer County Home. The town authorities said that they had granted the two franchises because they wanted the two companies to compete for the business.

Commissioner Carr finds, however, that as the Middleville company is four miles nearer the home than the Newport company, as the Newport company would have to build six miles of line, which would probably have to go through Middleville, and as the business to be secured would hardly warrant the remunerative construction of such a line, whereas there is no doubt of the ability of the Middleville company to construct a line and take the business, the application of the Middleville company should be approved.

The Second District Commission has issued a circular letter concerning the cancellation by the New York Telephone Company of a number of obsolete contracts not in conformity with the rates adopted recently in New York City. While in some instances the cancellation of the old contracts means an increase in telephone cost for subscribers, the commission points out that the old rates are in violation of the provisions of the law against discrimination. The holders of the old contracts will be placed on a par with all other users of telephones in the city. Last June the company proposed to terminate the contracts, but the commission postponed this action until the character and number of existing contracts providing for rates less than those fixed in the established schedules could be ascertained. It has now been found that, far from constituting a general raise in telephone rates or anything like it, the cancellation of the old contracts will place about 1700 subscribers now holding old contracts for lower flat-rate service on the same basis with the more than 500,000 other subscribers in the city.

On the opinion of Commissioner Carr the Second District Commission has decided that the charge of 50 cents a month for extension telephones is not unjust or unreasonable. The decision is on the complaint of Mr. Milford D. Whedon, of Granville, N. Y., against the New York & Vermont Home Telephone Company. The New York Telephone Company was allowed to intervene as a party in interest, and its studies and the investigations of the commission took much time. The commission decided previously that a telephone subscriber has not the right to install his own extension telephone set, as the telephone company is responsible for the standard and efficiency of service, which might be interfered with by equipment over which it had not control.

An interesting phase of the situation brought out by the witnesses of the telephone company, to which Mr. Carr refers in his opinion, is that the placing of an extension telephone increases the number of messages 15 per cent on a flat or message-rate line.

Mr. A. D. Welch, commercial engineer of the New York Telephone Company, testified before the Second District commission on June 21 as to the impossibility of a reduction in rates in the so-called Troy group in accordance with the complaint of residents, officials and organizations of citizens of Cohoes, Waterford and Watervliet. He testified that the company at present rates was losing $3,000 a year in Troy, $800 in Cohoes, $3,000 in Waterford and $4,000 in Watervliet. The hearing was adjourned until July 8.

Massachusetts Commission

The commission gave a hearing recently on a petition to compel the Western Union Telegraph Company to install stock-ticker service. The petitioner claimed that as the Western Union Company resells quotations to its subscribers, who have no connection with the New York Stock Exchange, the business is intrastate and subject to the jurisdiction of the board. Counsel for the Western Union company contended that the origin of the quotations in New York and their destination in local brokers' offices at Boston renders the business interstate and that the contract between the company and the exchange prohibits the former from supplying ticker service to any person or firm not approved by the latter. The board took the case under advisement.

Pennsylvania Commission

An effort was made by city officials of Philadelphia to have the Philadelphia Electric Company file an inventory of its property by July 1. The company stated that this would be impossible. Mr. William Draper Lewis declared that the company had agreed to have the inventory completed by the middle of May, and said that by this time the data should be in such shape that counsel for the complainant could go over the figures. Mr. Frederick W. Fleitz, on behalf of the company, said that the inventory could not be tabulated satisfactorily before Oct. 1. This statement was substantiated by the testimony of the engineer representing the company, Mr. Dugald C. Jackson.

District of Columbia Commission

The commission has ruled that interest need not be paid on deposits left with a company by a customer after the closing of his account. The ruling was made with the understanding that the company shall place on all final bills the following notice: "Please call for deposit if one has been made."

Members of the commission have assigned to themselves separate classes of subjects for consideration. Chairman Charles W. Kutz will take up matters of engineering, valuation and rates. Commissioner Brownlow will consider cases relating to jurisdiction, capitalization, financial operations and court proceedings. To Commissioner Newman service and accident cases will be referred.

California Commission

The Marin Water & Power Company has appealed to the Supreme Court from the decision of the commission fixing the price to be paid by the Marin Municipal Water District for the company's properties. This price was fixed by the commission in a decision rendered on April 9, 1915, at $1,200,150, and was the result of a proceeding brought under Section 47 of the public utilities act, which provides that the commission may determine the just compensation to be paid by any county, incorporated city or town, or municipal water district for the taking in eminent-domain proceedings of any public utility property and lands. The case is the first appeal which has been made from any decision of the commission under this section of the act.

Indiana Commission

The commission has ruled that the Winona Electric Light & Water Company must supply Winona Lake patrons with meters instead of charging a flat rate.

During the hearing in the case in which the city of Richmond seeks to condemn the plant of the Richmond Light, Heat & Power Company, under the utility law, Mr. George H. Olney of New York, general solicitor for the United Gas & Electric Corporation, the controlling company, was present. Messrs. A. C. Howard of New York and Ralph Estrada testified.

The State board of buildings and property of Indiana has let a new contract for five years for lighting the Statehouse and furnishing energy for elevators, motors, etc. The contract formerly was held by the Merchants' Heat & Light Company, but the new contract is with the Indianapolis Light & Heat Company. The rates are to be determined by the Public Service Commission on a demand and energy charge basis. The annual gross income under the contract to the Merchants' company has been about $3,000.

Illinois Commission

The complaint of Mr. J. B. Hogarth against the Northwestern Elevated Railroad Company and the Chicago Elevated Railways Collateral Trust has been dismissed by the commission. The complaint alleged that the elevated road and the trust are one body and constitute a public utility. The commission ruled that the trust is a separate organization.

Personal

Mr. A. G. Blankenship has been appointed manager of the Downs (Kan.) Electric Light & Power Company.

Mr. James D. Valentine has been appointed city electrician of Springfield, Ill., succeeding Mr. Herman Armbruster.

Mr. John J. Flynn has been elected president of the Vergennes (Vt.) Electric Company to succeed Mr. Charles E. Parker.

Mr. W. S. McCall has been elected president of the Brookfield (Mo.) Electric Light Company to succeed Mr. P. W. Morrison.

Mr. H. O. Hallen has been appointed successor to Mr. L. B. Kundsen as manager of the Ord (Neb.) Electric Company.

Mr. John H. Rogers has been elected successor to Mr. J. M. Briggs, president of the Deposit (N. Y.) Electric Company.

Mr. J. George Kaelber has been elected to succeed Mr. O. B. Grant as president of the Ridgway (Pa.) Electric Light Company.

Mr. George Barthell has succeeded Mr. M. W. Zumhoff as local agent at Palouse, Wash., for the Washington Water Power Company.

Mr. John A. Laing has been elected president of the Hood River (Ore.) Gas & Electric Company to succeed Mr. L. P. Hewitt.

Mr. L. T. McWilliams has been appointed manager of the Kaufman (Tex.) Electric Light Company to succeed Mr. E. A. Sweet.

Mr. W. L. McCulloch has succeeded Mr. Phil Johnson as engineer of the Springfield (Ore.) power station of the Oregon Power Company.

Mr. T. H. Stearns has been elected president of the Jefferson City (Mo.) Light, Heat & Power Company, succeeding Mr. W. N. Carnahan.

Dr. Asa L. Patten has been elected president of the Buzzards Bay Electric Company of Falmouth, Mass., to succeed Mr. Allen A. Brown.

Mr. Henry Zum Berge has been appointed manager of the Independence (Mo.) municipal lighting plant as successor to Mr. A. L. Nichols.

Mr. C. S. Emmert is the new manager of the Leavenworth (Kan.) Light, Heat & Power Company, a subsidiary of the United Gas & Electric Company, succeeding Mr. W. H. Fellows, who was acting in that capacity.

Mr. John S. Musser, president of the Dauphin Electrical Supplies Company, Harrisburg, Pa., was elected president of the Pennsylvania Electrical Contractors' Association at its annual meeting, held at Philadelphia last week.

Mr. H. S. Newton has been appointed manager of the Ohio Valley Electric Railway Company at Huntington, W. Va., and of its subsidiary property at Kenova, the Consolidated Light, Heat & Power Company, to succeed Mr. W. W. Magoon.

Mr. G. R. Milford has been appointed superintendent of operation for the Northern California Power Company, with headquarters at Volta, Cal. Mr. Milford will have charge of the company's power houses at Volta, Kilarc, Inskip, South and Coleman.

Mr. Roland French has been appointed manager of the Leipsic (Ohio) Electric Light Company. Mr. French was formerly in the employ of the Marconi Company as wireless operator and construction engineer, and until recently was stationed in Honduras.

Mr. E. F. Putnam, formerly commercial agent of the United Electric Light & Water Company at South Norwalk, Conn., has been appointed assistant superintendent of the Naugatuck district of the same company and of the Seymour Electric Light Company.

Mr. E. F. Stone, superintendent of light and power of the Arkansas Valley Railway Light & Power Company, Pueblo, Col., has been elected vice-president and director of the Pueblo Commerce Club. Mr. Stone has been chairman of the Manufacturers' Bureau of the club for some time and will continue to serve in that capacity also.

Mr. C. D. Wheeler has been appointed assistant sales manager and advertising manager of the Santo Manufacturing Company, Philadelphia, Pa. He had been connected with the Fort Wayne Works of the General Electric Company for a number of years.

Mr. F. W. Ballard, commissioner of light and heat for the city of Cleveland, Ohio, has been retained to superintend the extension of the municipal lighting system at Kalamazoo, Mich. As Mr. Ballard, it is explained, will give only a portion of his time to the Kalamazoo work, Cleveland will continue to have the benefit of his service also.

Mr. H. C. Couch, the new president of the Arkansas Association of Public Utility Operators, is the president and general manager of the Arkansas Light & Power Company, which operates a number of electric-lighting and water-works properties in the State. Mr. Couch was born in Columbia County, Ark., in 1877. He left the farm at the age of seventeen and after attending school at Magnolia entered the railway mail service in 1897. This position he resigned in 1905 after having organized the North Louisiana Telephone Company, of which he was president and general manager. The system grew rapidly, and in 1909 it, with several other companies, was merged into the Southern Telephone Company, of which Mr. Couch became vice-president and general manager. Continuing its aggressive policy, the new company acquired a number of independent properties in Arkansas and Louisiana, and was sold to the American Telephone & Telegraph Company in 1912. The system at the time of the transfer was made up of about seventy-five exchanges and 3000 miles of long-distance lines. In 1913 Mr. Couch organized the Arkansas Light & Power Company, which has since purchased a number of lighting and water properties in representative towns of Arkansas. The company's headquarters are at Arkadelphia, Ark., and it operates generating stations in Arkadelphia, Camden, Magnolia and Malvern.

H. C. COUCH

Mr. Ernest A. Edkins, who was elected first vice-chairman of the Commercial Section of the National Electric Light Association at the latter's San Francisco convention in June, is secretary of the advisory committee of the Commonwealth Edison Company of Chicago and also superintendent of the company's welfare and employment bureau. Mr. Edkins was born in England, Oct. 4, 1869, and, with his parents, came to Canada at an early age, subsequently moving to the United States. He was educated in public and private schools at Worcester, Mass., Hartford, Conn., and New York City. At first he began the study of law, but shortly abandoned this for newspaper work, starting as a reporter on the New York *Evening Sun* at the age of eighteen. Continuing in newspaper work for the next four or five years in the East and Middle West, Mr. Edkins in 1893 joined the staff of the Chicago Edison Company (the predecessor of the Commonwealth Edison Company), and he has continued his connection with the Chicago central-station company in various capacities for the last twenty-two years. For several years Mr. Edkins acted as editor of the *Edison Round Table*, issued by the Commonwealth Edison Company Section of the N. E. L. A., and in 1911 and 1912 he compiled

E. A. EDKINS

the association "Question Box" for the N. E. L. A. Mr. Edkins has written extensively on welfare work and utility operation and has been active in the electrical development work conducted by the Commercial Section. He has served on the section's executive committee and is chairman of its publications committee.

Mr. Russell H. Ballard, secretary and assistant general manager of the Southern California Edison Company, Los Angeles, Cal., who was elected vice-president of the National Electric Light Association at its San Francisco convention early in June, has been identified since 1897, except for a short interval, with the interests now incorporated under the above title. Mr. Ballard was born at Hamilton, Ont., in 1875, and began his business career at the age of fifteen as office boy for the Thomson-Houston Electric Company at Chicago, meanwhile putting himself through a strenuous course at night school. When his firm was absorbed by the General Electric Company in 1894 Mr. Ballard was transferred to the latter's treasury department at Schenectady, N. Y. During his connection with the General Electric Company he was assigned to various important branches of the company throughout the East and became intimately acquainted with the financial problems of the industry, as well as acquiring an accurate knowledge of electrical operation and an extensive commercial experience. Going to Los Angeles from the General Electric Company, Mr. Ballard entered the employ of the Westside Lighting Company, the predecessor of the Edison Electric Company of Los Angeles, as bookkeeper. In 1900 he became cashier and office manager of the Butte Electric & Power Company of Butte, Mont., where he remained until 1904. Accepting an offer from the Edison Electric Company to become its auditor, he returned to Los Angeles and entered upon a career which has demonstrated remarkable ability for organization, untiring energy, and a diligence which has made him a recognized master of the complicated and perplexing problems that confront the successful executive of a large and progressive electric corporation, successively advancing through various important positions, from auditor to secretary and assistant general manager.

R. H. BALLARD

Obituary

Elmer Phipps, superintendent of the Everett (Mass.) electric-lighting plant, died June 23 at the age of fifty-four.

J. Henry Kuehling, a retired electrical man of Washington, D. C., is dead at the age of seventy-four years. Death was caused by heart disease.

Richard Gilpin, a consulting electrical engineer of Philadelphia, died recently at his summer cottage at Cape May, N. J., as the result of contracting a severe cold. Mr. Gilpin was a bachelor.

L. M. Heath, who died at Hanover, N. H., June 22, as the result of an automobile accident, was for years identified with electrical development on the White River in Vermont, and was treasurer and manager of the White River Electric Company, which furnishes electric service at Randolph, Vt.

Nicholas Penniman Bond, a well-known attorney of Baltimore, Md., and the organizer of the old Edison Electric Light Company of Baltimore, died at his summer home at Blue Ridge Summit, Md., June 21. Mr. Bond had effected the consolidation of the local Edison company with the Brush and the United States Electric Light & Power Company, and afterward served as counsel for the new corporation. He was also an organizer of the Chesapeake Electric Light & Water Company, subsequently known as the Baltimore County Electric Light & Water Company.

Corporate and Financial

American Cities Company, New Orleans, La.—In a letter to the stockholders announcing the partial deferment of dividends, President Hugh McClosky says in part: "The outbreak of the European war has affected business conditions throughout the entire country and the earnings of public service corporations dependent on the prosperity of the communities which they serve. In addition to this, the street-railway earnings have been affected by the advent of the so-called 'jitney automobile.' The companies serving Memphis and Little Rock have been particularly affected by the condition of the cotton and hard-wood markets. The earnings of the Birmingham property have been affected by the practical cessation of the steel business in that district, which only now shows signs of improvement. In practically every locality in which the 'jitney automobile' is operating regulatory measures have been effected in the interest of public safety, and competition from this source is gradually decreasing. The subsidiary companies have spent on development of the properties since June 1, 1911, approximately $10,000,000, $1,000,000 of which has been provided from current surplus earnings of subsidiaries, and the balance from sale of securities, and with the resumption of normal conditions the subsidiaries will be prepared to handle a greater volume of business and add a much larger percentage to surplus earnings than would ordinarily be obtained. While the percentages charged against earnings for maintenance, renewals and replacements were thought to be fully adequate at the time of the formation of your company, these charges have nevertheless been increased, so that since 1911 $1,250,000 has been expended out of earnings of your properties in excess of the percentages expended previously. The American Cities Company, even under the unfavorable business conditions under which the subsidiaries have been operating for the last six months, has received sufficient dividends from the subsidiaries during this period to declare a dividend of 1½ per cent on the preferred stock, and has earned in excess of this amount approximately $100,000. Your company has an accumulated surplus from previous cash dividends received from its subsidiaries of $291,000, which could be used for dividend purposes at the present time, but taking into consideration business conditions generally, your directors felt that in the interest of stockholders a conservative policy dictated conservation of the resources and the payment of only the amount received from dividends from subsidiaries for the actual six months' period. Your preferred stock is cumulative, and therefore the 1½ per cent in arrears is only deferred and will be paid as soon as earnings justify. Strict economies have been introduced in the subsidiary companies, new avenues of business are being developed by the experts who are managing your properties, and your directors believe the loss of earnings will be temporary."

Baltimore Consolidated Gas, Electric Light & Power Company.—The plan for selling stock to its customers, as announced in these columns on June 19, is operating successfully, according to the latest official reports. Up to the close of business on June 30, 317 customers had subscribed for a total of 1481 shares. This is an average of 4.675 shares per subscriber. The company has 126,000 customers. At present subscriptions are received daily from between twenty and thirty customers. The company expects during the last few days of the initial monthly period, which ends on July 10, to receive a vastly larger number of subscriptions. Those who were identified with the conception of the plan express themselves as pleased with the results so far. The customers of the company are showing more eagerness to be stock holders than had been anticipated.

Camaguey (Cuba) Electric Company, Ltd.—Shareholders of the company have voted to give an option for ninety days to the Electric Bond & Share Company to purchase control of the property at $50 a share, or $500,000.

Citizens' Light, Heat & Power Company of Alabama.—Under a decree rendered by Judge Gaston Gunter in the Montgomery (Ala.) City Court, Mr. T. J. Reynolds became receiver for the company. The proceedings were directed by the Central Trust Company of Illinois as trustee, to foreclose a deed of trust secured by an issue of $50,000 bonds.

Great Western Power Company, San Francisco, Cal.—The first annual report for the year ended Dec. 31, 1914, shows the number of customers to be 17,000, an increase of 12,772 in the last three years. The connected load was 171,000 hp., or an increase of 61,000 hp. since Jan. 1, 1912. During 1914 the output amounted to 248,470,000 kw.-hr., the maximum demand being 75,500 hp. The annual load-factor was 64 per cent and the demand factor 45 per cent. The earnings statement of the Great Western Power Company and subsidiary companies and the Western Power Company follows:

Gross earnings:		
Light	$729,902	
Motor service	895,421	
Railway companies	440,587	
Municipal	42,754	
Other electrical corporations	549,937	
Steam service	15,981	
Rents of meters, etc.	2,035	
Miscellaneous electric revenue	3,854	
Electric merchandise and jobbing revenue	27	
Breakdown service	600	
		$2,681,098
Less—Operating and general expenses:		
Generating	$275,382	
Distribution	314,373	
Steam service	31,091	
Energy purchased	15,765	
Total	$636,611	
General expenses	100,899	
Total	$737,510	
Taxes	136,253	
		873,763
Balance		$1,807,335
Add—Other income:		
Interest charged to capital account:		
On current construction	$94,443	
On excess investment over requirements for present operation	151,401	
	$245,844	
Interest received on treasury bonds	42,450	
Dividends on California Electric Generating Company preferred stock	48,625	
	$336,919	
Less:		
Uncollectible electric bills	$8,734	
Rentals	6,091	
Non-operating expenses	6,823	
Non-operating taxes	4,811	
Net interest paid	12,548	
Amortization of discount and expenses (on bonds and notes issued since Jan. 1, 1913, only)	51,676	
	90,683	
		246,236
Total		$2,053,571
Interest on funded debt		1,280,849
Balance of income before providing for depreciation		$772,722

Kanawha Traction & Electric Company, Parkersburg, W. Va.—An issue of $1,100,000 two-year 5 per cent mortgage gold notes is offered at 98.25 and interest to yield about 6 per cent. The notes are due on June 15, 1917. The company, which was incorporated in April of this year, was consolidated on June 7 with the Parkersburg, Marietta & Interurban Railway Company. The company has a funded debt, including the present issue, of $1,950,000, and an outstanding capitalization of $1,100,000 common stock and $1,078,500 of 6 per cent preferred stock, which will be cumulative after July 1, 1916. The proceeds derived from the sale of the notes are to be used to pay the present unfunded indebtedness of constituent companies, to build the new power station and necessary transmission lines, for improvements and betterments, and for other corporate purposes. The company at present owns and operates plants at Parkersburg and Marietta having an aggregate rating of 4000 hp which supply energy to Parkersburg, Marietta, Lowell, Beverly and Williamstown, besides many smaller towns along the transmission lines. A new station is now being built at Parkersburg, on the Ohio River, which will permit the present Parkersburg station to be closed and the Marietta station to be used as a steam reserve plant. The initial installation will amount to 6250 kva, with provision for an ultimate rating that will reach 11,250 kva.

Kansas City (Mo.) Railway & Light Company.—The time limit for the acceptance of the franchise granted the Kansas City Railways, formed to take over the subsidiary electric railway properties in Kansas City, has been extended for four months from July 7. The proposal to extend the time for acceptance of the franchise was sent to the Council with a request from Mayor Jost that it be granted.

Middle West Utilities Company, Chicago, Ill.—Owing to the unsettled conditions during the past year, the annual report says, the increase in gross business of the subsidiary operating companies has not been equal to what might have been expected under normal conditions. This has been more marked in some territories than in others. It has been felt particularly in those parts of Illinois that depend largely for prosperity on coal industries. To a somewhat smaller extent the same conditions existed in Kentucky coal regions. All subsidiary operating companies suffered from the general curtailment of business during the period covered by the report. However, they are now furnishing an aggregate of over 150,000 customers with public utility service, and any improvement in the general business of the country will be reflected in an increase in their earnings. The combined earnings of the various subsidiary operating properties for the year ended April 30, 1915, follow:

Gross earnings		$7,634,745
Operating expenses, including taxes		4,877,016
Net earnings from operation		$2,757,729
Bond, debenture and other interest charges paid outside holders	$1,307,629	
Dividends on stock and proportion of undistributed earnings to outside holders	310,428	
		1,618,057
Earnings accruing to Middle West Utilities Company		$1,139,672
Gross income Middle West Utilities Company		$1,528,855
Expenditures:		
Administration expense	$121,291	
Miscellaneous charges, including taxes	42,184	
Depreciation and losses on investment	5,380	
		168,855
Balance		$1,360,000
Interest on collateral notes and bonds	$215,287	
Interest on collateral loans, etc.	163,396	
		378,683
Net income for year		$981,317
Preferred dividend, paid and accrued to date		598,048
Balance		$383,269
Appropriated toward writing off the discount on company's own securities		80,000
Balance		$303,269
Proportion of subsidiary operating companies' aggregate surplus for the year		78,504
Combined surplus earnings accruing to Middle West Utilities Company		$381,773

Midland Counties Public Service Corporation, San Luis Obispo, Cal.—The California Railroad Commission has extended until May 31, 1916, the authority heretofore granted to issue $275,000 of refunding bonds to retire a like amount of bonds of the Midland Counties Gas & Electric Company, and to issue $546,000 of refunding bonds to retire a like amount of bonds of the Coalinga Water & Electric Company.

Mississippi River Power Company, Keokuk, Iowa.—The company has signed a long-term contract with a new metal-reducing company for an ultimate supply of 20,000 hp. The initial installation calls for 4000 hp., which will be furnished late in the current year.

Mount Konocti Light & Power Company, Lakeport, Cal.—The California Railroad Commission has authorized the issue of $25,000 capital stock on account of extensions to the electric distributing system.

Ohio Power Company, Fremont, Ohio.—The Public Utilities Commission has authorized the company, which is the successor of the Sandusky River Power Company, to issue $700,000 first mortgage bonds.

Pacific Gas & Electric Company, San Francisco, Cal.—From the date of the initial offering of the new 6 per cent cumulative first preferred stock on June 3, 1914, to April 30, 1915, 4430 subscriptions, aggregating $9,895,200, have been received by the company for this issue. Of this amount, $6,039,600, or 60 per cent, was taken by stockholders under the original offering, and the remaining 40 per cent, or $3,855,600, has been subscribed by employees, customers and others. The growing appreciation among investors of this stock is reflected in the sales made since Jan. 1, 1915, as follows: In January, $303,400; February, $210,800; March, $241,600; April $334,000; total, $1,089,800. Little or none of this stock has been sold outside of California, the company having announced some time ago that it would limit sales to people residing within and contiguous to the territory served by it. The geographical distribution of the ownership of the stock, as of April 30, 1915,

including all first preferred stock issued and subscribed for was as follows:

	Stockholders	Shares	Par Value
California	4,535	240,304	$24,030,400
Pacific Coast outside of California	48	6,743	674,300
Middle States	597	48,378	4,837,800
Eastern States	1,058	183,195	18,319,500
Foreign	421	41,425	4,142,500
Total	6,659	520,045	$52,004,500

Pacific Light & Power Corporation, Los Angeles, Cal.—An issue of $2,338,000 of two-year 6 per cent collateral-trust notes due July 1, 1917, is offered at 99½ and interest. The statement for the year ended April 30, 1915, follows:

Gross income	$2,873,858
Operating expenses, maintenance and taxes	976,543
Net income	$1,897,315
Annual interest on bonds outstanding with public and alive in sinking funds	1,115,560
Balance available for interest on above notes	$781,755
Annual interest on above notes	140,280
Balance	$641,475

United Light & Power Company, San Francisco, Cal.—The company has filed an application with the California Railroad Commission requesting approval of a plan for reorganization differing from that previously presented in the following particulars: (1) The aggregate amount of the proposed bonded debt of the Consolidated Electric Company is reduced from $3,000,000 to $2,500,000. (2) The face amount of the bonds to be delivered to Mr. E. W. Wilson in payment of the purchase price of the properties of the United Light & Power Company and subsidiaries is reduced from $2,450,000 (less $243,000 face amount of underlying bonds) to $2,267,500 (less $243,000 face amount of underlying bonds). (3) The proposal to issue $71,000 bonds of the Consolidated Electric Company to the Great Western Power Company has been eliminated. (4) The purchase price of $400,000 face amount of bonds of the Consolidated Electric Company to be purchased by the Great Western Power Company has been reduced from par to 85. It is proposed to issue the bonds in the denominations of $1,000, $500, $250 and $100, instead of in the denominations of $1,000 and $100, and also to omit from the pledged property the stock of the United Light & Power Company and subsidiaries.

Washington-Oregon Corporation, Vancouver, Wash.—The property of the corporation is to be offered at public sale, according to an agreement reached before Judge Cushman in the United States court. Attorneys report that opposition has been removed, and a decree was presented for foreclosure of a $1,569,000 mortgage, under which the Fidelity Trust Company of Philadelphia is trustee. The properties to be sold include a power and water plant in Hillsboro, Ore., an electric railway system between Centralia and Chehalis, a power plant in southwest Washington, serving large areas in that district, and an electric railway system in Clarke County. Advices from the first and consolidated mortgage bondholders' committee state that the sale will probably be postponed for a month or more. It is expected that the property will be purchased by the bondholders' reorganization committee.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—The New York Stock Exchange has listed $19,572,000 Guaranty Trust Company of New York certificates of deposit for convertible sinking 5 per cent bonds of the company, due in 1931.

West Virginia Traction & Electric Company, Wheeling, W. Va.—An issue of $1,500,000 of two-year 6 per cent collateral gold notes due on June 1, 1917, is offered at 98 and interest to yield over 7 per cent. Earnings of the company and its subsidiaries for the twelve months ended April 30, 1914 and 1915, follow:

	1915	1914
Operating revenues	$896,108	$879,979
Operating expenses and taxes	462,372	453,964
Operating income	$433,736	$426,015
Other income	5,425	7,528
Gross income	$439,161	$433,543
Interest on bonds of subsidiary companies	193,726	195,417
Balance	$245,435	$238,125
Other deductions	20,690	17,610
Balance applicable to notes	$224,745	$220,515

Manufacturing and Industrial

Order for Receptacles for Seaside-Resort Hotel.—Some 2500 composition receptacles made by the Chelten Electric Company, Philadelphia, Pa., were installed by the Keller Pike Company of Philadelphia in the new Traymore Hotel at Atlantic City.

The Metalyte Company, 366 West Fifteenth Street, New York, has opened an office at 412 Fort Dearborn Building, 105 West Monroe Street, Chicago, Ill., which is in charge of Mr. J. L. Brautigan, who was formerly in charge of the company's Winnipeg office.

Opening of General Electric Company's New Building.—It is reported that more than 5000 persons were present at the opening of Building No. 6 of the General Electric Company's plant at Erie, Pa. The building will be used for amusement and entertainment purposes.

The C & C Electric & Manufacturing Company, Garwood, N. J., manufacturer of direct-current motors, generators and electric arc-welding apparatus, announces that its Montreal agent, Mr. J. D. Lachapelle, has removed his offices from 33 Herald Building to 26 Victoria Square.

The Franklin Electric Manufacturing Company, Hartford, Conn., has removed its New York City office from 47 West Street to the new Equitable Building, 120 Broadway. Mr. H. J. Solon, formerly Pittsburgh manager for the Westinghouse Lamp Company, is now the New York manager for the Franklin Electric Manufacturing Company.

Separator Pulleys for Smelters.—The Cutler-Hammer Clutch Company, Milwaukee, Wis., recently received an order for nine magnetic separator pulleys to be used in the Washoe smelters of the Anaconda Mining Company. The equipment will be utilized for removing iron such as broken drills, coupling pins, etc., from material about to be delivered to the crushers or pulverizers.

Increasing Use of Small Motors on Dutch Farms.—According to Commercial Attaché Erwin W. Thompson, stationed at The Hague, there is a steady and increasing demand for small motors for threshing, grinding, feed cutting and churning. Germany previously furnished most of the electrical machinery, but as this source of supply is now practically unavailable, the field is inviting, it is declared, for American enterprise.

Outing for Employees of Fort Wayne Electric Works.—On Saturday, June 26, some 3000 employees of the Fort Wayne (Ind.) Electric Works of the General Electric Company embarked on an excursion from Fort Wayne to Cincinnati, Ohio, where they held their annual outing at Coney Island, an amusement resort of Cincinnati. Three special trains were employed to carry the visitors, and representatives of the Chamber of Commerce of Cincinnati assisted in taking care of them.

Trade Between America and Sweden.—The Swedish Chamber of Commerce of the United States of America, with headquarters in the Produce Exchange Building, New York, is endeavoring to establish closer trade relations between the United States and Sweden. It directs special attention to the possibilities for disposing of American products at the present time, because of the fact that the war has largely cut off the sources of supply formerly extant in Germany and Great Britain.

Prizes for Salesmen of Electric Heating Company.—Among those receiving prizes at the recent meeting of the Rice Leaders of the World Association at New York were five salesmen of the Simplex Electric Heating Company of Cambridge, Mass. Mr. E. R. Jacobs, Chicago representative of the company, took first prize, which consisted of a touring car. Other prize winners were Mr. E. B. Stebbins of Philadelphia, Mr. H. F. Holland of Los Angeles, Mr. R. P. Ingalls of North Lexington, Mass., and Mr. R. C. Libbey of Jamaica Plain, Mass.

The Mutual Electric & Machine Company of Wheeling, W. Va., manufacturer of switchboards, knife switches, electrical cabinets and material for electric starters for automobiles, has leased a four-story building at the northeast corner of Fort Street and Fourth Street, Detroit, Mich., where it will maintain a manufacturing plant. The company will be represented in Detroit by Mr. H. J. L. Frank,

general manager, Mr. L. H. Frank, sales manager, Mr. F. A. Hagan, engineer, and Prof. George H. Morse, consulting engineer.

Belgium Business Men Organize.—Mr. Willy Lamot of Antwerp, writing to the ELECTRICAL WORLD from Shardhighs, Halstead (Essex), England, announces that several Belgian business men have formed an organization to introduce various American products in Belgium as soon as the war is over and to employ as agents a large number of Belgian manufacturers and business men who have been partly ruined, financially, although still possessing enough capital to re-engage in business. These men can give the necessary guarantees as agents, dealers, etc.

New Westinghouse Building in Cleveland.—It is reported that the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has made plans for completely remodeling its plant at 1220 West Fifty-eighth Street, Cleveland, Ohio, and replacing all its wooden structures with fireproof buildings. Preparations are now being made for an addition to the foundry which will make it one of the largest in the country. A permit was taken out June 17 for additions and alterations to the buildings that will entail an expenditure of about $100,000. The improvements will cost about $500,000, it is reported.

Welding Scrap-Nickel Anodes.—The Prest-o-Lite Company, Indianapolis, Ind., has recently conducted some experiments with the welding of nickel anodes by the oxy-acetylene process, and as a result, the company claims that it is possible to save a large number of worn nickel anodes which would otherwise be scrapped. The anodes used by the Prest-o-Lite Company are castings of 90 per cent nickel, 8 per cent carbon and 2 per cent iron. They are elliptical bars approximately 1.5 in. by 3.25 in. in cross-section and 30 in. long, each weighing about 30 lb. The process consists of "tacking" on scraps of old anodes by welding to increase the surface. One, two, three and sometimes four pieces of scrap are welded on, depending on the size and weight desired. The welding flame is also employed to remove the brass hooks which are used to support the anodes while in solution.

Combined Engineering and Sales Agency.—A company known as the Electrical Sales Engineers, Inc., recently formed in Chicago, intends to furnish for the convenience and benefit of its customers combined engineering and sales service. Although combined service of this type is novel in the field of commercial endeavor, the officers of the company express the belief that agencies to be successful in the electrical business must sell not merely goods but goods and service. The officers of the company are: President and general manager, Mr. Paul W. Koch, formerly manager for the Thomas G. Grier Company of Chicago; vice-president, Mr. Fred B. Duncan, formerly sales engineer for the George Cutter Company of South Bend, Ind., and secretary-treasurer, Mr. Alfred O. Dicker, formerly illuminating engineer of the Commonwealth Edison Company of Chicago. The new agency will represent the Condit Electrical Manufacturing Company of Boston, Mass., maker of circuit-breakers and protective apparatus, and the Luminous Unit Company of St. Louis, Mo., the manufacturer of "Brascolite" and "Day Way" lighting fixtures. The company opened its new office at 19 South Fifth Avenue, Chicago, on July 1.

Commutating-Pole Rotary Converters for Coal-Mining Service.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has received an order from the Stonega Coke & Coal Company of Virginia for twenty-four 150-kw. rotary converters of the commutating-pole type, designed to operate at 275 volts and 1200 r.p.m. The units will be placed in twelve underground substations which will be supplied with energy purchased from the Kentucky Utilities Company. The energy will be delivered to five points at a pressure of 33,000 volts and will be stepped down to 2300 volts for distribution. At the latter pressure the energy will be transmitted to the mine, where there will be two banks of transformers, each bank consisting of three 50-kva., single-phase units wound for 2300 volts for the high-tension side and the rotary-converter voltage on the low-tension side. Each substation will be controlled by a five-panel switchboard. Another installation with apparatus similar to the above, except that it will be above ground, is that for the Conemaugh Smokeless Coal Company in the Pittsburgh district, which will consist of one 200-kw. rotary converter. The machine will be of the bracket type and the frame of rolled steel, the feet being pressed out of a single sheet. The Westinghouse company has also recently built a 300-kw., 275-volt rotary converter of the commutating-pole type and a machine similar in design, with a rating of 500 kw., for the Lehigh Coal & Navigation Company at Lansford, Pa.

Promising Field for Electric Appliances in Canadian Cities.—Consul Henry P. Starrett, stationed at Fort William, Ont., Canada, reports that in few localities on the American continent are the prospects for introducing electric cooking and heating devices more promising than in the twin cities of Fort William and Port Arthur. In certain sections of the Province of Ontario and in western Canada, Mr. Starrett asserts, a rate as low as 1 cent per kw.-hr. on a special meter for heating and cooking is offered. Where stove coal costs $8.50 to $9 per ton and cut wood $6 to $7 per cord, cooking by electricity at these rates amounts to less than half of the cost under the old practice. Owing to the favorable conditions manufacturers of electric appliances have succeeded in developing an active demand for their products in middle and western Canada. Coal stoves are being displaced by electric ranges, Mr. Starrett declares, just as fast as the resources of the customers permit, and even in workingmen's homes electric irons and table hot-plates are to be seen in constantly growing numbers. Mr. Starrett states that there are approximately 8000 dwelling houses in Fort William and Port Arthur, and at least 5000 of these homes can afford to own one or more electric appliances. It is believed that an average expenditure of $20 for each house is not too high an estimate, especially in view of the fact that many homes have such equipment to the value of over $200 each. On this basis there is, therefore, a possible market for approximtaely $100,000 worth of these products, only a small percentage of which has actually been supplied. In this district the demand is for ranges having two or three burners, oven and warming shelf, table hot-plates, toasters and flatirons. The demand for warmers and radiators has not developed to the same extent as that for the appliances just named, but the interest in such articles is increasing. The market for electric washing machines is also said to be good. Vacuum cleaners have also been favorably received. It is difficult to get an accurate idea, Mr. Starrett states, as to the extent of the market in Canada, for electrical appliances, because of the fact that the statistics covering importation and domestic production group these articles with other electrical apparatus. It is thought, however, that 65 per cent of the electric appliances used in Canada are made in the United States. In this connection, also, it is interesting to note that many of the Canadian factories are owned by or controlled as branches of well-known American companies. There is said to be little or no importation of these articles from other foreign countries.

NEW YORK METAL MARKET PRICES

	June 22 Selling Prices Bid	Asked	June 29 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot*	82 15 0		82 2 6	
Prime Lake	20.00	to 20.50	19.75	to 20.00
Electrolytic	19.75	to 20.00	19.50	to 19.75
Casting	18.87½	to 19.12½	18.62½	to 18.87½
Copper wire base	21.50	to 22.00†	21.50	to 22.00†
Lead	5.75		5.75	
Nickel	50.00†		50.00†	
Sheet zinc, f.o.b. smelter	30.00†		27.00†	
Spelter, spot	18.00	to 18.50†	21.50	to 22.50†
Straits tin	41.30†		40.12½	
Aluminum, 98 to 99 per cent, prompt delivery	31.00	to 33.00	30.00	to 32.00

*OLD METALS

Heavy copper and wire	18.75	18.25
Brass, heavy	15.00	14.00
Brass, light	11.50	10.50
Lead, heavy	5.00	5.00
Zinc, scrap	14.50	13.50

*COPPER EXPORTS

Total tons to June 29 15,451

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Industrial Companies

The Kingsville Auto & Electric Company of Kingsville, Tex., has been incorporated with a capital stock of $2,000 by C. H. Flato, Jr., J. D. Finnegan and E. W. House.

The Wolfsperger Electrical Company of Akron, Ohio, has been incorporated with a capital stock of $5,000 by W. R. Wolfsperger, Frank M. Peck, William H. Mallery, J. V. Kahl and S. E. Klein.

The Rochester Electrical Supply Company of Rochester, N. Y., has been incorporated with a capital stock of $25,000 by Carl F. W. Kaelber, Clarence M. Platt and Bernard E. Finucane, all of Rochester.

The Argus Sign Company of East Orange, N. J., has been granted a charter with a capital stock of $125,000 to manufacture electric signs. The incorporators are Harvey Deschere, Paul R. Deschere and Walter L. Dreyfuss.

The General Radio Company of Boston, Mass., has been chartered with a capital stock of $30,000 to manufacture and deal in electrical machines, etc. The officers are William A. Kneeland, president, and J. Porter of Newton, treasurer.

The Comet Storage Battery Company of Long Island City, N. Y., has been incorporated with a capital stock of $10,000 to do a general electrical contracting business. The incorporators are J. A. Hurst, Hugo and G. Kiel, 963 Third Avenue, Long Island City.

The Spring & Buckley Company of New Britain, Conn., has been granted a charter with a capital stock of $50,000 to do general electrical work, etc. The incorporators are John H. Buckley of New Britain, G. K. Spring of Newington, and C. R. Jones of Hartford.

The McHugh Electric Company of Wilmington, Del., has been incorporated with a capital stock of $25,000 by George McHugh, Joseph H. McCleary and Richard W. Crooko, all of Wilmington, Del. The company purposes to do a general electrical and mechanical engineering business.

W. R. Townley & Company of Canandaigua, N. Y., have been incorporated with a capital stock of $5,000 to manufacture and deal in lightning conductors, wire cable, fire-extinguishing apparatus, etc. The incorporators are Patrick H. Menihan, Milton Rapalee and William R. Townley of Chapin.

The Neenan Traction Elevator Company of New York, N. Y., has been chartered with a capital stock of $200,000 to manufacture and deal in elevators, hoisting machinery and dynamos. The incorporators are John V. Judge, Charles MacDonald and John F. Healy, Webster Avenue, New Rochelle, N. Y.

Franklin Williams of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 for the purpose of doing a general mechanical and electrical engineering business. The incorporators are Anthony F. Bargmann, Adolph C. Wappler and Robert L. Degroff, 32 Nassau Street, New York City.

The Shongo Construction Company of Rochester, N. Y., has been incorporated by C. Ludington, D. L. Taylor of Rochester, and J. J. Shea of Buffalo. The company is capitalized at $50,000 and proposes to do a general contracting and construction, electrical and mechanical engineering business.

Frazer & Burchenal of New York, N. Y., have filed articles of incorporation with a capital stock of $25,000 for the purpose of doing a general contracting, electrical and construction engineering business. The incorporators are J. S. Frazer, S. D. Buchenal, 80 Maiden Lane, New York, N. Y., and F. L. Linden, Atlantic Highlands, N. J.

The Imperial Display Fixture Manufacturing Company of Fullerton, Pa., has been chartered with a capital stock of $100,000 for the purpose of manufacturing various kinds of electrically operated display fixtures adaptable for every line of mercantile business. H. F. Brown of Allentown, mechanical engineer, is interested in the company.

The Jefferis Norton Corporation of New York, N. Y., has been incorporated by Joseph F. Curtin, Samuel B. Howard and S. A. Anderson, all of New York. The company is capitalized at $5,000,000 and purposes to deal in and with gases which have been separated, machinery for compression, air compressors, electrical machines, engines, etc.

New Incorporations

The Horse City Light & Power Company of Elizabeth, Ky., has been chartered with a capital stock of $10,000 by J. P. Todd and others.

The Fox Lake Light & Power Company of Fox Lake, Wis., has been incorporated with a capital stock of $5,000 by D. C. West and others.

The Cross Plains Electric Company of Cross Plains, Wis., has been incorporated with a capital stock of $5,000 by F. J. Saeman, Henry M. Zander and James G. Bailey.

The Chrysler Light & Power Company of Belfield, N. D., has been chartered with a capital stock of $25,000 by George S. Chrysler, M. J. Coleman and John J. McManus.

The Akron & Laketon Utility Company of Laketon, Ind., has been incorporated with a capital stock of $25,000 for the purpose of constructing an electric-lighting plant in Laketon.

The Cedarville Park Power & Electric Company of Cedarville, Ill., has been incorporated by William M. Clingman, John Bollman and Smith C. Thompson. The company is capitalized at $5,000.

Trade Publications

Anchors.—The Dicke Tool Company, 61 Broadway, New York, has prepared bulletins which contain information and illustrations on screw, drive and "ant-hill" anchors.

Electric Churn.—The Dazey Churn & Manufacturing Company, St. Louis, Mo., has published an illustrated catalog giving information on its electrically operated churn.

Electric Pumping for Irrigation.—Fairbanks, Morse & Company, Chicago, Ill., have recently issued Catalog 114 A, which contains information on electrical apparatus for irrigation pumping.

Wiring Devices.—The Cutler-Hammer Manufacturing Company has prepared a wall hanger, 18 in. by 32 in. in size, which illustrates various types of push-button sockets, switches and other wiring devices.

Screwless Shade Holder.—The Plume & Atwood Manufacturing Company, Waterbury, Conn., is sending out an illustrated folder on its screwless socket covers and shade holders with wing-locking device.

Flow Meter.—The British Thomson-Houston Company, Ltd., Rugby, England, has published Descriptive List No. 6500, which describes and illustrates its types F, F-2, F-4, F-5 and T-3 steam, water and air-flow meters.

Wooden Poles.—The W. F. Goltra Tie Company, Cleveland, Ohio, has published a catalog which contains specifications and price lists on its wooden poles for telegraph, telephone, railway and transmission-line service.

Steel Poles.—The Carbo Steel Post Company, Chicago, Ill., has prepared an illustrated bulletin which contains information on various types of steel poles for telephone, telegraph, electric-railway and transmission-line service.

Combination Vacuum Cleaner and Carpet Sweeper.—The Pneuvac Company, Boston, Mass., has prepared an illustrated folder the subject of which is an electrically operated vacuum cleaner mounted on an ordinary carpet sweeper.

Glassware for Producing Daylight Conditions.—The Gleason-Tiebout Glass Company, 51 West Twenty-third Street, New York, is sending out a folder which describes the "celestialite" glassware which it has recently developed.

Ornamental Lighting Fixtures.—The Friedley-Voshardt Company, 733 South Halsted Street, Chicago, Ill., has issued a large illustrated catalog on indirect-lighting bowls, semi-indirect rings, shower plates, "body" fixtures and brass stampings.

Illumination of Billboards and House Lighting.—The Edison Lamp Works of the General Electric Company, Harrison, N. J., have issued a booklet entitled "The Illumination of Billboards," designated as B-3337, and a booklet entitled "How Our House Is Wired," designated as B-3301-3. The latter publication points out the value of electric service in the home and describes the proper methods of arranging lighting fixtures, etc.

Construction News

New England

CANAAN, N. H.—The Canaan El. Lt. Co. has applied to the Public Service Commission for permission to do business in the towns of Canaan and Enfield and to purchase the electrical equipment of the American Woolen Co. in Enfield.

EASTHAMPTON, MASS.—The Easthampton Gas Co. is now installing stoker equipment for two boilers. John N. Lyman is superintendent.

HUDSON, MASS.—Within the next 30 days the Electric Light Department expects to erect a transmission line to Boon and Stow, a distance of two miles, to supply electricity to the summer cottages there. George A. Brothers is manager.

LUDLOW, MASS.—The Ludlow Mfg. Associates is contemplating extensive improvements to its plant and changing its lighting system to 60 cycles. A new power house, it is understood, will be erected.

MANSFIELD, MASS.—The town of Mansfield is now installing about 50 street lamps of 40 cp., replacing about 100 old-style bracket lamps, and extending the commercial system of the municipal electric plant in various parts of the town. Material has been purchased. George W. Wood is manager.

MARLBORO, MASS.—The Marlboro El. Co. is contemplating the installation of an ornamental street-lighting system on Main Street. The present plans provide for about 30 lamps of 1000 cp. (type C). As yet nothing definite has been decided upon. The company also expects to install within the next six months about 100 flatirons. Chester A. Davis is local manager.

PLYMOUTH, MASS.—The Plymouth El. Lt. Co. expects to install thirty-two ornamental lamps (inverted arc) and about ½ mile of underground conduit. E. P. Rowell is manager.

SPRINGFIELD, MASS.—Bids will be received by the Fire Commission of the city of Springfield, addressed to the city clerk, until July 12, for construction, and also plumbing, heating and electrical work, for the additions and alterations to the Winchester Square fire station. Separate proposals to be submitted for each division of the work. Plans and specifications may be obtained at the office of B. Hammett Seabury, architect, 21 Beese Place, Springfield.

WALTHAM, MASS.—The Board of Aldermen has adopted a resolution providing for the installation of new lamps on Main and Moody Streets.

Middle Atlantic

BROCTON, N. Y.—The village of Brocton has voted to grant the Niagara & Lake Erie Pwr. Co. of Fredonia a franchise to erect transmission lines to supply electricity to manufacturing plants and other industries in the village. The municipal plant does not furnish motor service.

BROOKLYN, N. Y.—Bids will be received by the commissioner of water supply, gas and electricity, Room 2351, Municipal Building, New York, until July 12 for alterations and improvements at New Utrecht pumping station, corner of Avenue V and East Fourteenth Street, and converting same into a distribution station as follows: (1) For all mason work, steel and iron work, sheet metal work, roofing, glazing and electrical work; (2) plumbing and gas fitting; (3) steam-heating work. Blank forms, proposals and contracts, including specifications, can be obtained at the above office. William Williams is commissioner.

BUFFALO, N. Y.—Plans are being considered by Captain Norton, acting commissioner of public works, which he will submit to the Council, for illuminating the streets in outlying districts with incandescent lamps.

BUFFALO, N. Y.—Plans have been adopted by the Hospital Commission for the construction of the tuberculosis hospital to be erected on the West Farm site. The plans call for two brick and concrete buildings, a service building, a psychopathic ward, a power plant and a garage. Proposals for the work will be opened July 9.

CALLICOON, N. Y.—The Callicoon Independent El. Co. has applied to the Public Service Commission for permission to erect an electric plant in the towns of Callicoon and Delaware, and for approval of the exercise of franchises received from the towns.

CHEMUNG, N. Y.—The Public Service Commission has authorized the Elmira Wtr., Lt. & R. R. Co. of Elmira to exercise its rights under a franchise to supply electricity in Chemung and to erect the necessary transmission and distribution lines.

COHOES, N. Y.—The Public Service Commission has granted the Cohoes Co. permission to erect and maintain an electric transmission line along the bank of the canal on state land between Cohoes and Watervliet. The company also applied for the approval of a franchise for the distribution of electricity in Green Island, which is held open for further consideration.

LITTLE FALLS, N. Y.—The installation of an ornamental street-lighting system on Main Street, from Alexander to Sixth Street, is under consideration. The cost is estimated at from $7,500 to $8,000.

NEW YORK, N. Y.—Plans have been filed by the Interborough Rapid Transit Co. for the erection of a one-story brick substation and power house (60 ft. by 100 ft.) at 211th Street, near White Plains Road, to cost about $50,000. George H. Pegram, 165 Broadway, New York, is architect.

PAWLING, N. Y.—Ralph A. Griffing, recently granted a franchise in Pawling, will erect a 11,000-volt transmission line from the hydroelectric power plant in Bulls Bridge, Conn., to Pawling, a distance of 10 miles, and also a substation at the northern end of the town. The street-lighting system will consist of ninety 40-watt and twenty 200-watt street series lamps.

BRACKENRIDGE, PA.—Bids are being asked by the City Council for a new electric-lighting system. The city, it is reported, will purchase electrical energy from one of its leading manufacturers.

PITTSBURGH, PA.—The contract for electrical work in connection with the new wing to the asylum for insane men at the City Poor Farm, Marshalsea, has been awarded to the Eastern El. Co., 6016 Center Avenue, Pittsburgh, at $7,909.

PITTSBURGH, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 30, for supplying to the experimental station, United States Bureau of Mines, Pittsburgh, Pa., one electric generator and generator panel. For details see proposal columns.

TOPTON, PA.—The Town Council is negotiating with the Allentown-Reading Trac. Co. to furnish electrical service in Topton. If satisfactory arrangements are made, energy will be supplied from the Kutztown plant of the company.

WILLIAMSPORT, PA.—Provision will be made for an ornamental lighting system in the specifications now being prepared for the new street-lighting contract.

HOBOKEN, N. J.—Bids will be received by the Board of City Commissioners until July 7 for lighting the streets and public places of the city for a period of one, three or five years from July 14, 1915.

SUFFOLK, VA.—The city of Suffolk is reported to have granted the Virginia Ry. & Pwr. Co. a renewal of its franchise for a period of 30 years. The company, it is understood, contemplates improvements to its system.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 15, for electrical work in the United States Treasury and Winder Buildings, in accordance with specifications, copies of which may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 15, for elevator repairs in the United States Treasury, Winder and Auditors' Buildings, Washington, D. C., in accordance with specifications, copies of which may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 13 for furnishing at the various navy yards and naval stations the following supplies: Norfolk, Va., Schedule 8500—eight steel corrugated furnaces and miscellaneous steel boiler tubes; Schedule 8512—three 50-kw. transformers; Schedule 8524—miscellaneous round-flange unions. Brooklyn, N. Y., Schedule 8523—200 chemical thermometers, 200 thermometers for storage batteries, miscellaneous mechanical thermometers, 1250 common mercurial thermometers, miscellaneous mercury thermometers for thermostats, and 150 water thermometers; Schedule 8525—600 receiver cords, miscellaneous twin-conductor wire, miscellaneous steel conduit; Schedule 8514—four horizontal swing check valves; Schedule 8524—six gage-testing outfits. F.o.b.: Schedule 8513—200 storage batteries; Schedule 8510—four air compressors. Annapolis, Md., Schedule 8509—one six-bearing, three-unit motor-generator set. Philadelphia, Pa., Schedule 8511—two 200-kw. generating sets. Boston, Mass., Schedule 8521—2800 ft. flexible voice tubing. Norfolk, Va., and Charleston, S. C., Schedule 8511—four 5-kw. turbo-generator sets; Schedule 8501—4942 lb. composition condenser tubes, two auxiliary condensers, two double-tube boiler injectors, two single-acting air pumps, four simplex vertical feed pumps, four duplex horizontal fuel-oil pumps. Brooklyn, N. Y.; Philadelphia, Pa., and Charleston, S. C., Schedule 8524—miscellaneous composition pipe fittings and miscellaneous composition unions. Bids will also be received at the same place until July 20 as follows: Brooklyn, N. Y., and Mare Island, Cal., Schedule 8504—one automobile ambulance. Pensacola, Fla., Schedule 8507—furnishing and erecting one oxygen and hydrogen gas-producing plant. Puget Sound, Wash., Schedule 8529—500 lb. brass tubing and miscellaneous sheet copper. Mare Island, Cal., Schedule 8529—600 lb. composition unions and miscellaneous rod copper. Bids will also be received until July 27 for furnishing two steam turbine-driven blowers at Mare Island, Cal., under Schedule 8508. Bids will also be received until Aug. 3 for supplying four water-tube boilers at Mare Island, Cal., as per Schedule 8516. Applications for proposals should designate the schedule desired by number.

North Central

ALBION, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 30 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Albion, Mich. Specifications may be obtained from the custodian of site at Albion or at the above office.

BARAGA, MICH.—The Village Council expects to purchase within the next six months a very small amount of material for distribution and lighting system, and within the next nine months a few electric irons. Robert E. Martin is superintendent.

BAY CITY, MICH.—Within the next three months the Bay City Electric Light Department expects to purchase fifty 4-amp. metallic-flame arc lamps. William H. Fitzhugh is superintendent.

HASTINGS, MICH.—The Michigan State Railroad Commission has granted the Thornapple Gas & El. Co. of Hastings permission to increase its capital stock from $100,000 to $500,000. Of the new stock, $220,000 is to be issued and sold at once at not less than par.

HUDSON, MICH.—Within the next 30 days the Hudson El. Lt. Co. expects to purchase one frequency-changer set (from 125-kw. to 175-kw. rating), the motor to be 25 cycles, three-phase, and the generator three-phase, 2300 volts, and three 125-kw. transformers, 13,200/33,000 volts primary and 4400 volts secondary, 25 cycles, three-phase. The company will also erect a boiler house and install one 150-hp boiler (already purchased) within the next four months. G. F. Avis is secretary.

ITHACA, MICH.—The Village Council is considering the installation of an ornamental street-lighting system, consisting of about 50 posts carrying three-lamp clusters. Within the next few months the Council expects to purchase some heating and cooking apparatus and household labor-saving devices, including vacuum cleaners, washing machines, etc. H. E. Churchill is superintendent.

KALAMAZOO, MICH.—The City Council has engaged F. W. Ballard, chief engineer of the Cleveland (Ohio) municipal electric-light plant, to make investigations relative to enlarging the municipal electric-light plant to enable it to supply electricity for commercial purposes.

LANSING, MICH.—The contract for lighting the Capitol Building for two years beginning next November has been awarded to the Michigan Pwr. Co. The municipal plant is now furnishing the service.

MILFORD, MICH.—Within the next six months the Milford El. Co. expects to purchase one 100-kw., three-phase, 60-cycle, 2300-volt synchronous (vertical) generator directly connected to water turbine, 200 to 225 r.p.m. C. C. Sherk is superintendent.

THREE RIVERS, MICH.—The City Council has adopted a resolution providing for the sale of the bonds to build the municipal electric-light plant and water-works station.

CANTON, OHIO.—The Canton El. Co. has petitioned the Public Utilities Commis-

sion for authority to issue $150,000 in bonds, the proceeds to be used for extensions and improvements.

CANTON, OHIO.—Residents on several streets not originally provided for in the new street-lighting system have petitioned the Council for the installation of ornamental lamps on those streets, and their request is receiving consideration.

CINCINNATI, OHIO.—The Charles McCaul Co., Tenth and Sansom Streets, Philadelphia, Pa., contractor for the construction of the new Hamilton County Court House, which will cost about $2,500,000, is planning to use electricity exclusively for power in the work. All lifts, mixers and other equipment will be electrically operated if arrangements can be made.

DAYTON, OHIO.—The Dayton Pwr. & Lt. Co. has completed the installation of wires and fixtures for the illumination of a section of the Cincinnati Pike (using 80-cp. tungsten lamps), as an illustration, for the benefit of the County Commissioners, of an effective system of lighting rural highways.

DELTA, OHIO.—The Delta El. Lt. Co. has applied to the Public Utilities Commission for permission to sell its property to the Ohio Gas Lt. & Coke Co. of Toledo for $21,000.

DILLONVALE, OHIO—Bids will be received by the Village Council, at the office of the village clerk, until July 6 for lighting the streets and public highways of the village of Dillonvale with electricity for a period of five years.

FREMONT, OHIO—The Ohio Pwr. Co. of Fremont, it is reported, has awarded the contract for construction of an auxiliary steam-power plant to the Worden-Allen Co. of Chicago, Ill. The equipment, it is said, will include three 6250-kw. steam turbines, four 150-hp. boilers, mechanical stokers and fuel-handling apparatus.

FREMONT, OHIO.—The city officials, it is reported, have decided to proceed with the construction of a municipal electric-light plant. The Supreme Court recently decided in favor of the city in injunction proceedings to prevent the sale of bonds for that purpose. H. Whitford Jones & Co., Citizens' Building, Cleveland, Ohio, are consulting engineers.

MASSILLON, OHIO.—The Public Utilities Commission has granted the Massillon El. & Gas. Co. permission to sell $115,000 in bonds at 80 and $125,000 in capital stock at 87.

NEW LEBANON, OHIO—Bids will be received by C. W. Piatt, village clerk, until June 16 for lighting the streets and public places, etc., with electricity for a period of 10 years.

NORWOOD, OHIO.—The city authorities are considering the extension of the alternating-current service installed by the city to a considerable section north of Williams Avenue.

PAINESVILLE, OHIO.—Bonds to the amount of $35,000 have been voted for extensions and improvements to the municipal electric-light plant. Preliminary plans have been prepared by H. W. Jones, consulting engineer, Citizens' Building, Cleveland.

SPRINGFIELD, OHIO.—Estimates have been prepared by M. J. Bahin, city engineer, for the proposed cluster-lamp lighting system, which provides for 294 three-arm standards, to cost installed complete $15,451. The City Commission, it is understood, has adopted the specifications and will soon let contracts.

TROY, OHIO—A resolution has been prepared providing for the sale of $10,000 in bonds, the proceeds to be used for improvements to the Miami County power plant. For further information address the president of the Board of Local Improvements.

OWENSBORO, KY.—Arrangements have been made for the installation of an ornamental street-lighting system in the Frederica and Second Street section of Owensboro. The plans provide for the erection of the lamps by the business men in that locality and for energy to maintain them, to be supplied by the municipal electric plant.

BURNETT'S CREEK, IND.—Frank S. Girard writes that he is not interested in a project to develop water-power to supply electricity in Idaville, as reported in the issue of June 19. He is contemplating utilizing a stream running through his property for a small plant for his own farm, but probably will not install it this year.

COLUMBUS, IND.—The Central Indiana Ltg. Co. of Columbus, has petitioned the Public Service Commission for permission to issue $3,500 in bonds, the proceeds to be used for improvements.

MARTINSVILLE, IND.—Within the next two months the Martinsville Gas & El. Co. expects to erect 25 miles of 16,500-volt transmission line to Morgantown and Brooklyn; also to purchase within the next 30 days switchboard panels, out-door high-voltage pole switches, fuses, lightning arresters, 400 kva. in transformers (16,500/2300 volts), poles, wires and insulators for 25 miles of line. The Reliance Engineering Co., Fourth National Bank Building, Cincinnati, Ohio, is consulting engineer.

MOORESVILLE, IND.—The Mooresville Utilities Co. expects to purchase within the next two months material for distribution and lighting system, including transformers, poles, incandescent lamps, wire, meters, etc.

MOUNT VERNON, IND.—The City Council is contemplating remodeling the municipal electric-light plant and installing an additional engine and generator, at a cost of about $15,000.

WINONA LAKE, IND.—The Public Service Commission has ruled that the Winona El. Lt. & Pwr. Co. of Warsaw must supply all its patrons in Winona Lake with meter service instead of charging a flat rate.

ALTON, ILL.—A resolution has been presented to the City Council asking that a committee be appointed to confer with the representatives of the Keokuk Pwr. Co. of Keokuk, Ia., in regard to furnishing the city with electricity.

CANTON, ILL.—The installation of a municipal electric-lighting plant in connection with the municipal water-works system is under consideration by the City Council. Plans have been prepared by City Engineer Brickner showing that the use of from 1200 to 1500 poles, carrying from 25 to 28 miles of wire, would be needed for the proposed street-lighting system.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, Room 700, 910 South Michigan Avenue, Chicago, until July 22 as follows: (A) For 4-amp. air-cooled, constant-current arc regulators; (B) hand-operated, single-pole, automatic oil switches; (C) 10-amp. oil-immersed, constant-current regulators. For details see proposal columns.

NEW HOLLAND, ILL.—The New Holland Lt. & Pwr. Co., recently incorporated with a capital stock of $4,000, is planning to furnish electrical service in the village of New Holland and to residents along the route of the transmission line from Mason City. Harry Cooper, G. A. Trenkle and James Ryan are interested in the company.

ONEIDA, ILL.—Preparations are being made by the Galva El. Lt. Co., of Galva, to rebuild its local system. Material for the work, it is understood, has been purchased.

BARRON, WIS.—The Barron Tel. Co., it is reported, will increase its capital stock from $50,000 to $100,000, and also install new switchboards, etc.

BELOIT, WIS.—Plans have been prepared for the installation of an ornamental street-lighting system, which provide for 94 ornamental standards mounted with tungsten lamps of 600 cp., to be maintained by underground wires. The cost is estimated at about $8,000. Contracts will be awarded in about 30 days. F. W. Dupke, 439 East Grand Avenue, Beloit, is chairman of lighting committee.

GRAND RAPIDS, WIS.—The city of Grand Rapids has purchased the property of the Grand Rapids El. Co., to be owned and operated by the municipality. M. N. Weeks is manager.

KESHENA, WIS.—Plans, it is reported, are being considered to install an electric-light plant here, to replace the one that was recently destroyed by fire.

MARSHFIELD, WIS.—The Board of Public Works is considering the installation of ornamental lamps on Central Avenue.

MILWAUKEE, WIS.—In a report submitted to F. G. Simmons, commissioner of public works, F. A. Vaughn, of Vaughn, Meyer & Sweet, engineers, Majestic Building, Milwaukee, recommends the installation of an entirely new street-lighting system, providing for approximately 8500 lamps. The report recommends municipal ownership and maintenance of the entire street-lighting distribution system, but does not make any recommendation with respect to the ownership of an electric generating plant.

PEPIN, WIS.—The Western Utilities Co., it is reported, has submitted a proposal to the Village Council to furnish electricity in Pepin.

DETROIT, MINN.—Bids will be received by the city of Detroit until July 19 for construction of city hall and fire station in accordance with plans and specifications prepared by C. E. Bell, architect, Security Building, Minneapolis. Separate bids will be received at the same time for heating, plumbing and electric work. Plans can be seen at the office of E. J. Bestick, city clerk, Detroit, or at the office of the architect.

LAKEFIELD, MINN.—Preparations are being made for improvements to the municipal electric-lighting plant, including the installation of an engine, two generators and a switchboard, and also about 175 new poles. Bids for the work will be opened in about two weeks. Earl D. Jackson, Capital Bank Building, St. Paul, Minn., is engineer in charge. J. J. Hartneck is superintendent.

MENAHGA, MINN.—The installation of an electric-lighting plant in Menahga is under consideration. B. Gunderson of Park Rapids is reported to be interested in the project.

ST. PAUL, MINN.—G. O. House, superintendent of the water department, is securing data relative to the cost of installing a central municipal electric-light and power plant to supply light and heat to the city hall, library, police station, auditorium, municipal garage and public utilities department building.

ST. PAUL, MINN.—Plans are being prepared for the construction of a new power plant for the St. Joseph's Hospital, St. Paul, to cost about $50,000, by C. L. Pillsbury, consulting engineer, Metropolitan Life Building, Minneapolis. New machinery, including boilers, engines, generators, etc., it is understood, will be required.

BANCROFT, IOWA—The City Council, it is reported, is considering issuing $10,000 in bonds for the installation of a municipal electric-light plant.

HAZLETON, IOWA—At an election held recently the proposal to issue bonds for the installation of an electric-light plant was carried.

MOUNT VERNON, IOWA.—The Wapsie Pwr. & Light Co., Mount Vernon, expects to erect within the next 30 days 10 miles of 33,000-volt transmission line, material for which has been purchased; also to purchase within the next 30 days street-lighting equipment and outdoor arresters. Kenneth Lindsay is manager.

ORANGE CITY, IOWA—Within the next two months F. W. Michel, proprietor of the local electric-light plant, expects to erect a steel smokestack, 38 in. by 60 ft., and one supply tank 12 in. in diameter and 12 ft. high.

RICEVILLE, IOWA.—Within the next six months the Riceville El. Lt. & Pwr. Co. expects to purchase one 100-hp. Diesel-type crude-oil engine; also within the next 12 months to purchase 12 meters and 24 flat-irons. L. E. Markham is manager.

ROLAND, IOWA—Bids will be received by the Board of Education, Roland, Iowa, until July 21 for construction of two-story and basement high and grade school building, including wiring, plumbing, heating and ventilating, in accordance with plans prepared by W. F. Gernandt, architect, State Bank Building, Omaha, Neb. Plans are on file at the office of the board, Roland; Builders' Exchange, Omaha, Neb., and at the architect's office.

SPRINGVILLE, IOWA—Within the next six months F. M. Hann, owner of the local electric-light plant, expects to make some extensions to transmission lines; also to purchase transformers, poles, lightning arresters, insulators, meters, etc.; also vacuum cleaners and washing machines.

STORY CITY, IOWA—Within the next 30 days the city of Story City expects to purchase hardware and insulators for three miles of transmission lines. M. Henderson is superintendent.

STUART, IOWA.—Within the next two or three months the town of Stuart expects to install a coal-handling system, including elevators, dumps, etc. G. F. Taylor is auditor.

WAUKON, IOWA.—Within the next two weeks the Interstate Pwr. Co. of Waukon expects to erect a fireproof fire substation, to replace the one destroyed by fire. M. S. Howard is general superintendent.

WILTON, IOWA—Bids will be received at Wilton, Iowa, until July 15 on addition to the power-plant equipment, consisting of Corliss releasing-valve-type engine driving a 75-kva. generator and exciter, switchboard panel, well-pump head and motor. David G. Fisher & Co. of Davenport, are engineers. For details see proposal columns.

DREXEL, MO.—The installation of a municipal electric-light plant in Drexel is under consideration.

KANSAS CITY, MO.—The Chicago & Alton elevators at Fifth Street and Lydia Avenue will be equipped with about ten motors of about 350-hp. rating.

LOUISIANA, MO.—The Louisiana Lt., Pwr. & Trac. Co. expects to install a 72-in. by 18-ft. boiler (already purchased) within the next 60 days. A. Vogel is general manager.

WEBB CITY, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 26 for lighting fixtures for the

United States post office at Webb City. Drawings and specifications may be obtained at the above office or from the custodian of site at Webb City.

LINTON, N. D.—The installation of an electric-light plant in Linton, to cost about $7,000, is under consideration. A. M. Baker of Morris is reported to be interested.

GIBBON, NEB.—The Kearney Wtr. & El. Pwr. Co., of Kearney, is negotiating with the Gibbon El. Lt. Co. with a view of purchasing the property of the latter. If the deal is consummated a 24-hour service will be established in Gibbon.

LAUREL, NEB.—The installation of an electric-lighting plant in Laurel is reported to be under consideration.

SHELTON, NEB.—At an election to be held July 27 the proposal to issue $8,000 in bonds for the purpose of purchasing the local electric-light plant, to be owned and operated by the municipality, will be submitted to the voters.

ARGENTINE, KAN.—The addition to the Santa Fé elevators at Argentine is to be equipped with motors of 500-hp. rating. The present elevator has a steam plant.

BELLEVILLE, KAN.—Within the next four months the city of Belleville expects to install in the municipal electric-lighting plant one 240-hp. Busch-Sulzer Brothers Diesel engine and a 200-kva. generator. Contracts have already been placed for equipment. W. G. Schaefer is city clerk.

EL DORADO, KAN.—Preparations are being made by the Kansas Gas & El. Co. of Wichita to take over the electric plant of the El Dorado El. & Refrigerating Co. Surveys are now being made for the transmission line to be erected from Valley Center to El Dorado, a distance of 28 miles. The company will also supply electricity in the town of Benton, which is on the line, and also to J. C. Robinson's ranch.

GALENA, KAN.—The Public Service Commission has granted the Empire Dis-electric-light plant in Linton, to cost about $93,000 in bonds, the proceeds to be used for extensions and improvements. The headquarters of the company are in Joplin, Mo.

GOFF, KAN.—The Town Council is considering calling an election to submit to the voters the proposal to issue bonds for establishing an electric-lighting system. It is proposed to erect a transmission line from Corning and Soldier (a distance of 12 miles), the town to pay half of the expense.

LARNED, KAN.—The Kansas Supreme Court has upheld the decision of the District Court of Pawnee County in approval of the bond ordinance of Larned, under which bonds were voted for an electric-light plant.

LUCAS, KAN.—Within the next 30 days the Electric Light Department expects to install a 37½-kw. generator with panel in the municipal electric-lighting plant. Equipment has already been purchased. F. O. Barr is superintendent.

LYONS, KAN.—The Lyons El. & Mfg. Co. has completed the installation of a 150-hp universal unaflow engine and a 125-kva Westinghouse alternator, directly connected. Dwight Chapin, Jr., is superintendent.

NESS CITY, KAN.—One 25-hp Fairbanks-Morse oil engine, one 20-kva, 2300-volt alternator and one 2½-kw exciter have recently been purchased for the municipal electric-light plant. George Abel is superintendent.

PERRY, KAN.—The electric-light commission expects to purchase within the next six months one 45-hp oil engine directly connected to a direct-current generator. Charles Burgess is superintendent.

WICHITA, KAN.—If given a new five-year contract for street lighting, the Kansas Gas & El. Co. offers to replace the 80-watt and 100-watt incandescent lamps now in use, of which there are 1079, with 100-cp. type C nitrogen-filled lamps, and will also make a reduction in the price of both incandescent and arc street lamps.

Southern States

SPRAY, N. C.—Plans are being prepared for construction of a 3000-hp plant for the Thread Mills Co. in Spray. F. P. Sheldon & Son, Industrial Trust Building, Providence, R. I., are architects and engineers.

WAKE FOREST, N. C.—At an election to be held July 27 the proposal to issue $10,000 in bonds for extensions to the municipal electric-light plant will be submitted to the voters.

CEDARTOWN, GA.—The Water and Light Department has recently purchased and expects to erect within the next two months one 600-gal. Manistee Iron Wks. Co. pump directly connected to a 50-hp, 2200-volt, 60-cycle General Electric motor. W. T. Hardy is superintendent.

QUITMAN, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 29 for the construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Quitman, Ga. Drawings and specifications may be obtained from the custodian of site at Quitman, or at the above office.

REIDSVILLE, GA.—The installation of an electric-lighting system and small ice plant is reported to be under consideration by the Southern Orchard Co. J. W. Agey is president.

BUENA VISTA, FLA.—Plans are being considered, it is reported, by Charles Deering of the William Deering estate for the construction of a power plant and service station on the estate north of Buena Vista, to cost about $200,000.

LEESBURG, FLA.—The Leesburg Ice Co. has purchased a two-stage centrifugal pump (250 gal. per minute) driven by a 20-hp Wagner El. Co. motor, directly connected. Fred E. Way is electrician.

BENTON, TENN.—Arrangements have been made by the Tennessee Pwr. Co. of Chattanooga and the local Board of Commerce whereby the company will supply electrical service in Benton. Under the agreement the company is to make the surveys and erect the transmission lines and the city to furnish the rights-of-way.

DANDRIDGE, TENN.—The Council is considering the installation of a municipal electric-lighting plant.

MARYVILLE, TENN.—Bids will be received by the Mayor and Board of Aldermen of the city of Maryville until July 7 for construction of complete water-works system, pumping station, including pumps, boilers and auxiliaries. Alternate bids will be received for electrically driven units. Plans can be seen and specifications may be obtained at the office of the Mayor of Maryville, and at the office of R. C. Huston & Co., engineers, 1028 Falls Building, Memphis.

NASHVILLE, TENN.—The Nashville, Springfield & Northern R. R. Co., of Nashville, recently incorporated, proposes to build an electric interurban railway between Nashville, Springfield, Clarksville, Tenn., and Franklin, Ky., a distance of 85 miles. E. G. Stribbling is president of the company and Robert C. Leonard is secretary and treasurer, both of Nashville.

BIRMINGHAM, ALA.—Application has been made by Hugh Friel, president, and Sydney J. Bowie, attorney of the Birmingham Wtr., Lt. & Pwr. Co., to the City Commission for a franchise to supply electricity for lamps and motors in Greater Birmingham. This company was recently organized to develop hydroelectric plants at Lock 17 on the Warrior River.

MONROE, LA.—The City Council has engaged Walter G. Kirkpatrick, engineer of Birmingham, Ala., to make investigations and report on condition of and improvement for the water, light and traction systems.

OKLAHOMA CITY, OKLA.—Application has been made to the City Council by Fred E. Sutton of the Mid-Continent Co., Terminal Building, and associates for a franchise to install and operate an electric and gas plant.

BARTLETT, TEX.—The Texas Pwr. & Lt. Co. of Dallas, has purchased the local electric-light plant and will connect it with its power transmission lines and make improvements to the local system.

DALLAS, TEX.—The contract for the electrical work of the proposed new high school building in South Dallas has been awarded to the F. E. Newberry El. Co., Century Building, Kansas City, Mo., at $5,280.

DALLAS, TEX.—The directors of the Texas Pwr. & Lt. Co. have voted to issue $140,000 additional bonds, the proceeds to be used in making improvements and extensions to its properties at Sherman, Denison and Waco.

GORDON, TEX.—The Gordon-Mingus Lt. Co. of Gordon has extended its transmission line to Mingus, a distance of 3 miles, to furnish electrical service there. W. S. Dawson is president of the company.

Pacific States

ABERDEEN, WASH.—The city of Aberdeen has granted George Tilden and associates, of Seattle, a franchise to supply electricity for lamps and motors here. Mr. Tilden, who proposes to develop a water-power site on the White River, in the vicinity of Tacoma, has applied to nearly every large city in southwestern Washington for a similar franchise.

COLVILLE, WASH.—The Stevens County Pwr. & Lt. Co. of Colville, has leased a large power site at Myers Falls from George E. Myers of Spokane. It is said that the company will develop it at once.

ELLENSBURG, WASH.—Application has been made to the County Commissioners by R. N. Bull for a 50-year franchise to erect and maintain electric transmission lines along the highways in Kittitas County. If granted a franchise, it is understood that the construction work will begin at once.

LANGLEY, WASH.—Investigations are being made by H. E. Woods, electrical engineer, Prince Rupert, B. C., Can., with a view of installing an electric-light plant to supply electricity in Langley and its immediate vicinity.

OKANOGAN, WASH.—The Commissioners of Okanogan County have granted the Arlington Mining Corpn. a franchise to erect a transmission line from the plant of the Okanogan Valley Pwr. Co. to the Arlington Mines, near Okanogan. Considerable electrical equipment is to be installed in the mines this season, and an electric tramway is under consideration. The work will be done under the supervision of J. B. Ingersoll of the Spokane & Inland Ry. Co. of Spokane.

PORT ANGELES, WASH.—The County Commissioners have granted J. L. Keeler of Sequim a franchise to erect and operate electric transmission lines along the highways between Sequim, Dungeness and Port Williams.

SPOKANE, WASH.—Hugh L. Cooper & Co., 101 Park Avenue, New York, N. Y., consulting engineers, it is reported, have been engaged to make an examination of the engineering and commercial possibilities of the so-called Z Canyon water-power on the Pend Oreille River, about 10 miles north of Metaline Falls.

YARDLEY, WASH.—Preparations are being made by the Washington Wtr. Pwr. Co. to install an electric-lighting system on the principal streets in the city.

BEND, ORE.—The City Council has decided to call an election Aug. 9 to submit to the voters the proposal to grant Messrs. Steidl & Tweet a franchise to supply electricity in Bend.

CORVALLIS, ORE.—Robert E. Strahorn, president of the Portland, Eugene & Eastern Ry. Co., has announced that the Southern Pacific Co. will equip its railway between Whiteson and Corvallis, a distance of 40 miles, for electrical operation, which will be an extension to the electric railway between Portland and Whiteson.

EUGENE, ORE.—Tentative plans, it is reported, are being considered by the city officials for the installation of an auxiliary steam-driven power plant in connection with the municipal plant. The present plans provide for a 1250-kw. plant.

KLAMATH FALLS, ORE.—Co-operative institutions to handle their business are the latest step taken by the framers of the Klamath project. These include the organization of the Water Users' National Bank, warehouses, power company, telephone system, a marketing organization and probably a store.

PRAIRIE CITY, ORE.—The Prairie Pwr. Co. of Prairie City expects to extend its transmission lines to John Day and to Canyon City this summer and will be in the market for a 500-kw. generator and water-wheel to operate under a 110-ft. head (using 75 second-ft. of water), wire and other material. R. C. Reese, president, has charge of the work.

SEASIDE, ORE.—The City Council has entered into a contract with the Pacific Lt. & Pwr. Co., which furnishes local service, for a system of streamer lamps for the entire length of Broadway, the principal street leading to the beach, and also for several blocks of the cross streets in the business portion of the city.

CHICO, CAL.—The City Trustees are considering a plan for municipal ownership of the street-lighting system and have asked the power companies to submit bids for furnishing electricity for same.

PASADENA, CAL.—The installation of an ornamental lighting system on Bellefontaine Street, between Fair Oaks and the Arroyo Seco, is under consideration.

WILLIAMS, CAL.—The Board of Supervisors has adopted a resolution calling for bids for the construction and operation of an electric-light plant in Williams. Plans for street-lighting provide for 34 lamps.

PLEASANT GROVE, UTAH.—The city of Pleasant Grove has engaged Messrs. Caldwell & Richards, consulting engineers, Vermont Building, Salt Lake City, to prepare preliminary plans for the proposed

municipal electric-light plant. As yet nothing definite has been done. Joseph Hilton is recorder.

PRESCOTT, ARIZ.—The proceeds of the $200,000 in bonds recently issued by the Arizona Pwr. Co. of Prescott will be used for the construction of a second hydro-electric plant on Fossil Creek, near here.

Canada

TORONTO, ONT.—Plans, it is understood, are being developed by the Hydro-Electric Power Commission of Ontario which provide for an ultimate development of 250,000 hp., the larger portion of which will probably be derived from developments on the Welland Canal and on the Niagara River.

NEW LIVERPOOL, QUE.—The city of Liverpool, it is reported, is contemplating the installation of a new power plant and electric-lighting system.

QUEBEC, QUE.—With a capital stock of $3,000,000 and extensive powers a company has been incorporated to develop hydro-electric power and supply electricity in the cities of Quebec and Three Rivers and in the counties of Quebec, Levis, Beauce, Dorchester, Port Neuf, Montmagny, Megantic, Champlain, St. Maurice, Charlevoix and Saguenay. The incorporators are: Charles H. Branchaud of Outremont, Milton Lewis Hersey, engineer, and Howard Murray, manager, of Westmount, Thomas McDougall of Montreal, and Julian C. Smith of Westmount.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 16, for furnishing galvanized steel, steel billets, steel cable, electric cable, brass wire, lamps, electric-lamp clusters, gaskets, rubber valves, boiler lagging, tile duct, calcium carbide, etc. Further information relating to this circular (No. 943) may be obtained from Major F. C. Boggs, general purchasing officer.

Directory of Electrical Associations

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C. Meeting, San Francisco, Aug. 2-7.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Meeting, San Francisco, Sept. 16-18.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, William H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. President, R. K. Sheppard, B. F. Goodrich Co., Akron, Ohio.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Assistant secretary, Walter Neumuller, Irving Place and 15th St., New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. T. Snyder, McKeesport, Pa. Annual meeting, Hotel Statler, Detroit, Sept. 8-11.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, 10 Adelaide Street East, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col. Annual convention, Glenwood Springs, Sept. 23-25.

COMMERCIAL SECTION, N. E. L. A. Secretary, C. A. Littlefield, 130 East 15th St., New York.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, Lee Hagood, General Electric Co., Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF ILLINOIS. Secretary, H. E. Chubbock, Peoria, Ill.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, A. D. Page, 30 Church St., New York.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall, 29 West 39th St., New York. Sections in New York, New England, Chicago, Philadelphia, Washington and Los Angeles.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Wier, Athens, Ga.

ILLUMINATING ENGINEERING SOCIETY. General secretary, C. A. Littlefield, 29 West 39th St., New York. Annual convention, New Willard Hotel, Washington, D. C., Sept. 20-23.

INDEPENDENT TELEPHONE ASSOCIATION OF AMERICA. Secretary, W. S. Vivian, 19 South LaSalle St., Chicago.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skilman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 71 Broadway, New York.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Next annual convention, Cincinnati, Aug. 24-26.

INTERNATIONAL ENGINEERING CONGRESS. Secretary-treasurer, W. A. Cattell, Foxcroft Building, San Francisco, Cal. Congress, San Francisco, Sept. 20-25.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 9-11.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thompson, Des Moines, Ia.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), Homer E. Niesz, Chicago, Ill.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West 8th Ave., Topeka, Kan.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 14 Seventh St. N., Minneapolis, Minn.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the National Electric Light Association. Secretary-treasurer, H. F. Wheeler, Hattiesburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, San Francisco, July 18-24.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Permanent headquarters, Room 204, Hotel LaSalle, Chicago, Ill.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, Mount Kineo House, Kineo, Maine, Sept. 14-17.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 365 East 21st St., Brooklyn, N. Y.

NORTHWEST SECTION, N. E. L. A. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Portland, Ore., Sept. 8-11.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, July 20-23.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Bldg., Portland, Ore.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, H. N. Müller, 435 Sixth Av., Pittsburgh, Pa. Annual meeting, Bedford Springs, Pa., Sept. 8-10.

Railway Signal Association. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southwestern Section, N. E. L. A. Secretary-treasurer, George H. Wygant, Tampa, Fla. Annual meeting, Asheville, N. C., Sept. 22-24.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Vermont Electrical Association. Secretary-treasurer, C. H. West, Rutland, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 Jackson Blvd., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 22, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,143,632. Illuminated Clock; H. Kienzle, New York, N. Y. App. filed Oct. 28, 1914. Lamp is disposed behind the translucent dial of the clock.

1,143,633. Means for Securing Contacts; C. J. Klein, Milwaukee, Wis. App. filed Oct. 28, 1913. Snap-switch stationary contact.

1,143,664. Self-Winding Electric Clock; U. L. Sundblad, New Haven, Conn. App. filed April 5, 1915. Automobile plug.

1,143,666. Commutator for Dynamo Machines; C. A. Vanderveil and A. H. Midgley, Acton Vale, England. App. filed May 6, 1913. Single brush for the commutator and the slip-ring.

1,143,676. Circuit-Closer; F. Williams, Somerville, Mass. App. filed May 10, 1913. For workmen's time register.

1,143,680. Telephone System; W. Aitken, Liverpool, England. App. filed Aug. 12, 1911. Improved switching for isolated exchanges.

1,143,682. Apparatus Appliance for Illuminating Cavities or Surfaces; R. Biquard, Paris, France. App. filed June 11, 1913. Refractory incandescent rod inclosed in transparent water jacket.

1,143,686. Printing-Press Controller; C. E. Carpenter, New York, N. Y. App. filed July 1, 1913. For automatically controlling press upon operation of the feeder clutch.

1,143,722. Photographic Device; H. Van R. Palmer, Dumont, N. J. App. filed June 20, 1913. For X-ray work.

1,143,799. Receiver for Wireless Telegraphy; R. B. Avery, South Bend, Ind. App. filed April 5, 1913. Used in connection with commercial lighting circuit.

1,143,809. Fire-Alarm System; C. F. Christman, Winslow, Ariz. App. filed May 19, 1914. For calling volunteer firemen.

1,143,810. Compression Rheostat; E. L. Clark, Lakewood, Ohio. App. filed May 31, 1912. Has readily replaceable resistor units.

1,143,818. Charging Storage Batteries; T. A. Edison, Llewellyn Park, West Orange, N. J. App. filed Jan. 17, 1912. Changes signal and control batteries along track bed by a charging battery on a traveling car.

1,143,820. Telephone Trunking System; E. D. Fales, La Grange, Ill. App. filed March 30, 1909. Automatic, employing switches of the Strowger type.

1,143,828. Process of Manufacturing Anodes; P. C. C. Isherwood, Bushey Heath, England. App. filed May 17, 1913. Employs natural manganese ores.

1,143,874. Trolley Retriever or Safety Device; M. A. Yeakley, Kamms, Ohio. App. filed Oct. 7, 1907. Improved mechanical construction and has only a single spring. (Seventy claims.)

1,143,875. Trolley Retriever; M. A. Yeakley, Canton, Ohio. App. filed Oct. 11, 1909. Has low panel and high power connections between the power spring and drums. (Fifty-five claims.)

1,143,883. Electric Stove; R. F. Boettiger, Aberdeen, Wash. App. filed March 15, 1915. Inexpensive and simplified construction.

1,143,909. Metallic-Filament Lamp; H. J. Jaeger, Weehawken, N. J. App. filed March 14, 1913. Has a coiled, cone-shaped constant filament.

1,143,937. Snap Lock for Electric Shells; T. A. C. Both, New York, N. Y. App. filed April 29, 1911. Movable locking ring.

1,143,940. Electric Furnace; J. W. Brown, Lakewood, Ohio. App. filed Jan. 8, 1912. For calcining cakes and manufacturing graphite.

1,143,948. Control System for Gun Mounting and Other Mechanism; A. T. Dawson, Westminster, London, and J. Horne, Barrow-in-Furness, England. App. filed July 12, 1912. Turret-training and gun-elevating mechanism.

1,143,955. Control System for Electric Motors; A. J. Hall, Wilkinsburg, Pa. App. filed Aug. 2, 1913. Overload trip device.

1,143,956. Control System for Electric Motors; A. J. Hall and L. G. Riley, Wilkinsburg, Pa. App. filed July 9, 1913. Single-phase electric-locomotive control.

1,143,963. Universal Load Box; J. L. Herman, Fort Wayne, Ind. App. filed Sept. 5, 1912. Non-inductive load in a transformer load box.

1,143,966. Flashlight; H. T. Hipwell, Pittsburgh, Pa. App. filed Oct. 31, 1914. Has a condensing lens in combination with the main lens.

1,143,983. Insulator Support; C. E. Miller, Pittsburgh, Pa. App. filed May 4, 1914. Wire helix serves as the threaded seat for the insulator.

1,143,998. Line Switch; J. G. Roberts, Dobbs Ferry, N. Y. App. filed May 10, 1913. For distributing trunk lines.

1,144,000. Treatment of Surfaces of Aluminum or Alloys of Aluminum in Order to Prepare Them for Receiving a Metallic Deposit; F. A. Roux, Paris, France. App. filed Jan. 19, 1914. Subjects previously cleansed surfaces to action of hydracide holding tin in solution.

1,144,011. Power-Transmission Mechanism; J. G. P. Thomas, Holywell, Wales. App. filed Oct. 24, 1910. Electro-mechanical power transmission for motor vehicles.

1,144,012. Speed-Controlling Device; A. Walton, Boston, Mass. App. filed March 20, 1911. For spinning and twisting machinery.

1,144,016. Magneto-Driving Mechanism; J. A. Williams, Cleveland, Ohio. App. filed Dec. 26, 1911. For producing "kick-off" sparks for starting.

1,144,117. Railway-Traffic-Controlling Apparatus; W. P. Allen, Ardmore, and G. R. Scattergood, Philadelphia, Pa. App. filed Jan. 4, 1913. Interlock system.

1,144,028. Protective Device; E. E. F. Creighton, Schenectady, N. Y. App. filed March 19, 1913. Free of the defects of usual spark-gap lightning arrester.

1,144,029. Protective Device; E. E. F. Creighton, Schenectady, N. Y. App. filed March 19, 1913. Disk and annular electrode in evacuated vessel.

1,144,032. Automatic Temperature-Regulating System; H. G. Geissinger, New York, N. Y. App. filed Feb. 26, 1910. Regulates heating medium and the proportion of air which is shunted around the heating device.

1,144,038. Electric Switch; E. H. Jacobs, Schenectady, N. Y. App. filed April 4, 1910. Speed of opening and closing independent of speed of operating handle.

1,144,047. Electric Switch; E. B. Merriam, Schenectady, N. Y. App. filed Feb. 4, 1910. Contacts separate in a compressed atmosphere of insulating gas.

1,144,063. Magnetically Operated Device; C. H. Rippl, Cleveland, Ohio. App. filed April 18, 1913. Prevents chattering of the oscillating armature.

1,144,084. Call-Distributing System; C. S. Winston, Chicago, Ill. App. filed Aug. 4, 1913. For interconnecting calling lines and idle operator's link circuits.

1,144,095. Support for Indirect or Semi-Indirect Lighting Fixtures; H. A. Bauer, Lansdowne, Pa. App. filed Jan. 6, 1915. Individual pull-chain control for lamps within the bowl.

1,144,101. Safety Device for Gasoline Motors; R. J. Bradbury, Denver, Col. App. filed March 12, 1914. Lights indicate amount of oil in crank case.

1,144,107. Switch Plate; W. H. Burt, Waterbury, Conn. App. filed Nov. 23, 1914. Concealed hinges for the cover plates.

1,144,114. Process of Mounting Metallic Filaments on Filament Carriers of Incandescent Lamps; O. Feuerlein, Charlottenburg, and M. von Pirani, Wilmersdorf, Germany. App. filed July 21, 1910. Filament first wound and distended on right support and then finally supported on pliable holders.

1,144,135. Ignition Timer; W. Kaisling, Chicago, Ill. App. filed July 21, 1913. Provides for permanent adjustment of certain parts.

1,144,149. Alternating-Current System; L. C. Marburg, Milwaukee, Wis. App. filed Jan. 7, 1910. Control of the storing and giving up of kinetic energy.

1,144,153. Insulator; W. H. Nichols, Bennington, Vt. App. filed June 15, 1912. Interchangeable and reversible two-part insulator.

1,144,201. Portable Flashlight; H. H. and H. T. Hipwell, Pittsburgh, Pa. App. filed March 25, 1915. Fountain-pen type.

1,144,210. Tool; R. Kincaid, Youngstown, Ohio. App. filed May 29, 1914. Lamp in handle illuminates working portion of tool.

1,144,224. Cable Tap; C. B. Mills, Baltimore, Md. App. filed Sept. 24, 1913. Avoids mutilation of the main cable.

1,144,225. Cable Connector; C. B. Mills, Gardenville, Md. App. filed Sept. 24, 1913. Joint avoiding the use of tape, etc.

1,144,226. Electroplating Process; C. B. Mills, Baltimore, Md. App. filed March 16, 1915. For electroplating cement and other non-metallic substances.

1,144,233. Time-Limit Circuit-Breaker; M. F. Owens, Hartford, Conn. App. filed Nov. 23, 1911. Allows flow of excess current at starting.

1,144,236. Transmitter or Reproducer; W. E. Pierce, San Francisco, Cal. App. filed Oct. 28, 1912. Sensitive device for engaging Morse characters in paper strip.

1,144,246. Driving of Vehicle; J. Rebstein, Winterthur, Switzerland. App. filed Nov. 25, 1913. Electric locomotive with counterweights balancing all cranks, etc.

1,144,252. Electrical Conductors; L. Roebel, Mannheim, Kaferthal, Germany. App. filed March 1, 1913. Stranded conductor for preventing of eddy currents in dynamo-electric machinery.

1,144,255. Electric Testing Instrument; H. Schade, Albany, N. Y. App. filed May 21, 1914. For use on automobiles.

1,144,264. Controlling System for Electrical Apparatus; S. K. Thompson, Jenkintown, Pa. App. filed Jan. 26, 1911. Motor-generator, storage-battery system.

1,144,271. Apparatus for the Continuous Production by Synthesis of Hydrogen Peroxide; W. Weber, Dusseldorf, Germany. App. filed Dec. 5, 1914. Electrolytic apparatus adapted to withstand high pressure.

1,144,290. Telegraphy; B. L. Bobroff, Milwaukee, Wis. App. filed Feb. 9, 1914. Dial telegraph.

1,144,299. Electric Regulation; J. L. Creveling, New York, N. Y. App. filed Jan. 5, 1910. Electromagnetically controlled compression resistance.

1,144,311. Storage-Battery Element and Method of Making the Same; J. Redding, Malden, Mass. App. filed July 10, 1914. Lead is electrolytically deposited upon the plate in minute trees or filaments.

1,144,330. Telephone Busy-Signal Apparatus; G. E. Kimball, Chicago, Ill. App. filed Sept. 19, 1906. Comprises only relays or electric magnets.

1,144,335. Excess Indicator; H. O. Swoboda, Edgwood, Pa. App. filed May 27, 1913. For producing "flickering" and then dimming the lamps when current is increased beyond the normal amount.

1,144,339. Means for Synchronously Displaying Cinematographic Pictures and Reproducing Sound; L. Gaumont, Paris, France. App. filed Jan. 4, 1907. Index means controlled from operation of one mechanism serves to facilitate control of the other mechanism.